OCTOBER 1987
Issue #325

73® Amateur Radio

USA $2.95
CAN. $3.95
A WGE Publication

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Microwave Made Easy

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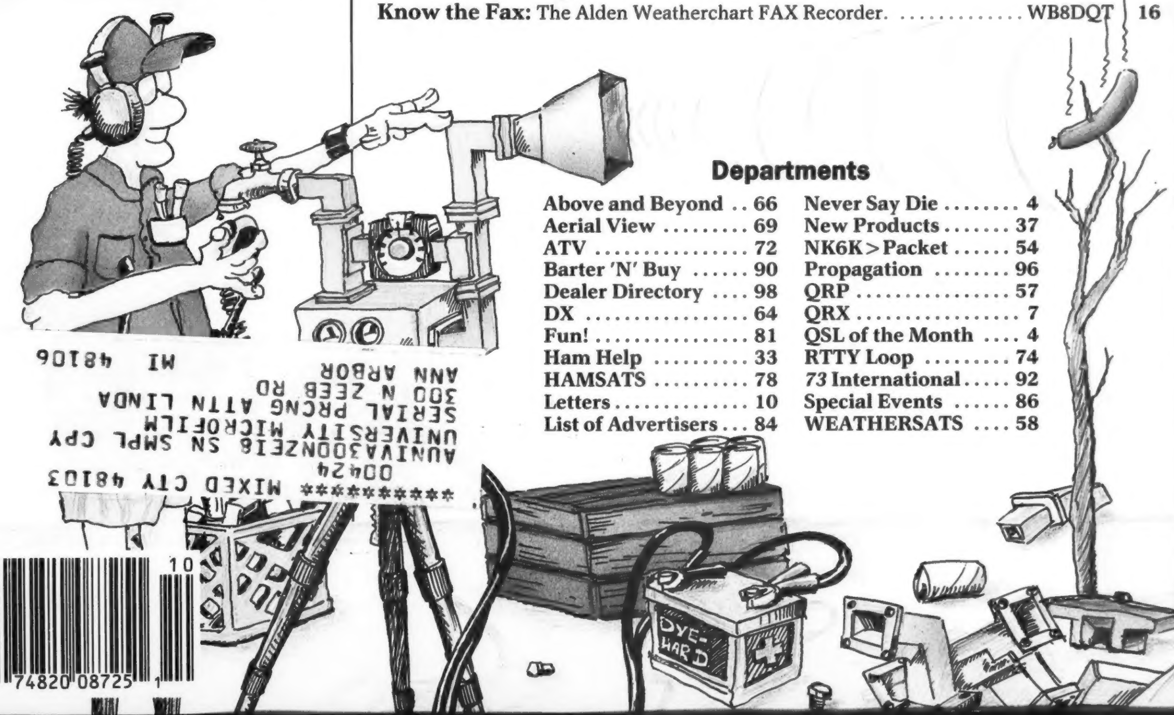

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ICOM IC-761
A NEW ERA DAWNS

- **Built-in AC Power Supply**
- **Built-in Automatic Antenna Tuner**
- **SSB, CW, FM, AM, RTTY**
- **Direct Keyboard Entry**
- **160-10m/General Coverage Receiver**
- **Passband Tuning plus IF Shift**
- **QSK up to 60 WPM**

The IC-761 ushers in an exciting new era of amateur radio communications; an era filled with all the DX'ing, contesting, and multi-mode operating pleasures of a fresh new sunspot cycle. The innovative IC-761 includes all of today's most desired features in a single full-size cabinet. This is ham radio at its absolute best!

Work the World. The IC-761 gives you the competitive edge with standard features including a built-in AC power supply, automatic antenna tuner, 32 fully tunable memories, self-referencing SWR bridge, continuously variable RF output power to 100 watts in most modes, plus much, much more!

Superb Design, Uncompromised Quality. A 105dB dynamic range receiver features high RF sensitivity and steep skirted IF selectivity that cuts QRM like a knife. A 100% duty cycle transmitter includes a large heatsink and internal blower. The IC-761 transceiver is backed with a full one-year warranty and ICOM's dedicated customer service with four regional factory service centers. Your operating enjoyment is guaranteed!

All Bands, All Modes Included. Operates all HF bands, plus it includes general coverage reception from 100kHz to 30MHz. A top SSB, CW, FM, AM, and RTTY performer!

Passband Tuning and IF Shift plus tunable IF notch provide maximum operating flexibility on SSB, CW, and RTTY modes. Additional features include multiple front panel filter selection, RF speech processor, dual width and adjustable-level noise blanker, panel selectable low-noise RF preamp, programmable scanning, and all-mode squelch. The IC-761 is today's most advanced and elaborate transceiver!

Direct Frequency Entry Via Front Keyboard or enjoy the velvet-smooth tuning knob with its professional feel and rubberized grip.

Special CW Attractions include a built-in electronic keyer, semi or full break-in operation rated up to 60 WPM, CW narrow filters and adjustable sidetone.

Automatic Antenna Tuner covers 160-10 meters, matches 16-150 ohms and uses high speed circuits to follow rapid band shifts.

Complementing Accessories include the CI-V computer interface adapter, SM-10 graphic equalized mic, and an EX-310 voice synthesizer.

You're The Winner with the new era IC-761. See the biggest and best HF at your local ICOM dealer.

ICOM
First in Communications

ICOM America, Inc., 2380-116th Ave. N.E., Bellevue, WA 98004 **Customer Service Hotline (206) 454-7619**
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ICOM CANADA, A Division of ICOM America, Inc., 3071 - #5 Road, Unit 9, Richmond, B.C. V6X 2T4 Canada

All stated specifications are approximate and subject to change without notice or obligation. All ICOM radios significantly exceed FCC regulations limiting spurious emissions. 761487.

THE ALL NEW PRIVATE PATCH IV BY CSI HAS MORE COMMUNICATIONS POWER THAN EVER BEFORE

- **Initiate phone calls from your HT or mobile**
- **Receive incoming phone calls**
- NEW! **Telephone initiated control . . .**
  - ✓ **Operate your base station with complete control from any telephone**
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POWER

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The new digital dialtone detector will automatically disconnect Private Patch IV if you forget to send # (to remotely disconnect) before hanging up. This powerful feature will prevent embarassing lock-ups.

The importance of telephone initiated control for emergency or disaster communications cannot be overstated. Private Patch IV gives you full use of the radio system from any telephone. And of course you have full use of the telephone system from any mobile or HT!

To get the complete story on the powerful new Private Patch IV contact your dealer or CSI to receive your free four page brochure.

Private Patch IV will be your most important investment in communications.

✓ = **NEW FEATURE**

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- ✓ Fully regenerated tone dialing
- Pulse dialing
- Toll protection
- Secret toll override code
- Busy signal disconnect
- ✓ Dialtone disconnect
- CW identification
- Activity timer
- Timeout timer
- ✓ Telephone initiated control
- ✓ Regenerated DTMF selective calling
- Ringout
- ✓ Ringout or Auto Answer on 1-8 rings
- Busy channel ringout inhibit
- ✓ Status messages
- ✓ Internally squelched audio
- MOV lightning protection
- ✓ Front panel status led's
- ✓ Separate CW ID level control
- ✓ 24 dip switches make all features user programmable/selectable.

- ■ Connects to MIC and ext. speaker jack on *any* radio. Or connect internally if desired.
- ■ Can be connected to any HT. (Even those with a two wire interface.)
- ■ Can be operated simplex, through a repeater from a base station or connected directly to a repeater for semi-duplex operation.
- ■ 20 minutes typical connect time
- ■ Made in U.S.A.

OPTIONS

1. ½ second electronic voice delay
2. FCC registered coupler
3. CW ID chip

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Torrance CA 90505
Phone: (213) 373-6803

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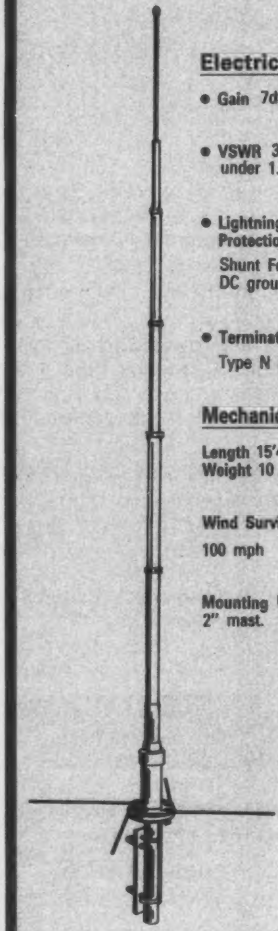
G7 - 144



Electrical

- Gain 7dBd
- VSWR 3 MHz under 1.5:1
- Lightning Protection Shunt Fed - DC ground
- Termination Type N Female

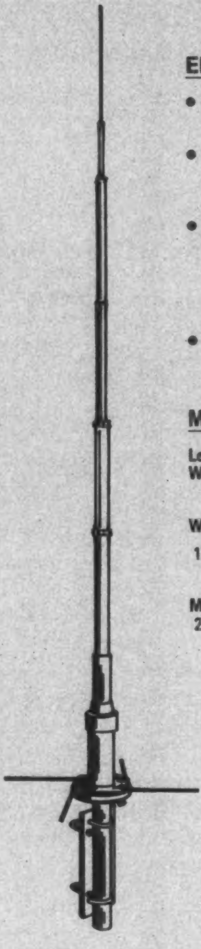
Mechanical

Length 15'4"
Weight 10 lbs.

Wind Survival
100 mph

Mounting Up to 2" mast.

G7 - 220



Electrical

- Gain 7dBd
- VSWR 4 MHz under 1.5:1
- Lightning Protection Shunt Fed - DC ground
- Termination Type N Female

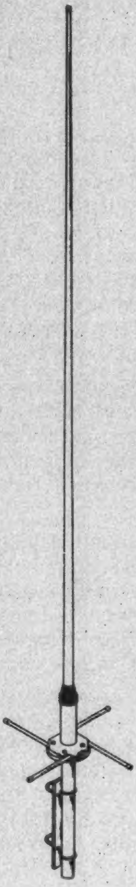
Mechanical

Length 10'2"
Weight 7.0 lbs.

Wind Survival
110 mph

Mounting Up to 2" mast.

G6 - 440



Electrical

- Gain 6dBd
- VSWR 8 MHz under 1.5:1
- Lightning Protection Shunt Fed - DC ground
- Termination Type N Female

Mechanical

Length 7'3"
Weight 16 lbs.

Wind Survival
125 mph

Mounting Up to 2" mast.

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CIRCLE 269 ON READER SERVICE CARD

MFJ ACCESSORIES

MFJ's BEST 300 WATT TUNER HAS A CROSS-NEEDLE METER THAT READS SWR, FORWARD AND REFLECTED POWER – ALL AT A GLANCE

MFJ-949C
$149.95

MFJ's best 300 watt tuner is now even better! **The MFJ-949C all-in-one Deluxe Versa Tuner II** gives you a tuner, cross-needle SWR/Wattmeter, dummy load, antenna switch and balun in a compact cabinet. You get quality conveniences and a clutter-free shack at a super price.

A cross-needle SWR/Wattmeter gives you SWR, forward and reflected power -- all at a single glance. SWR is automatically computed with no controls to set. 30 and 300 watt scale on easy-to-read 2 color lighted meter (needs 12 V).

A handsome black brushed aluminum cabinet matches all the new rigs. Its compact size (10 x 3 x 7 inches) takes only a little room.

You can run full transceiver power output -- up to 300 watts RF output --and match coax, balanced lines or random wires from 1.8-30 MHz. Use it to tune out SWR on dipoles, vees, long wires, verticals, whips, beams and quads.

A 300 watt 50 ohm dummy load gives you quick tune ups and a versatile six position antenna switch lets you select 2 coax lines (direct or thru tuner), random wire or balanced line and dummy load.

A large efficient airwound inductor -- 3 inches in diameter -- gives you plenty of matching range and less losses for more watts out. 100 volt tuning capacitors and heavy duty switches give you safe arc-free operation. A 4:1 balun is built-in to match balanced lines.

Order your convenience package now and enjoy.

MFJ 12/24 HOUR LCD CLOCKS

13:00
1:00
13:00

MFJ-108 $19.95 **MFJ-107 $9.95**

Huge 5/8 inch bold black LCD numerals make these 24 hour LCD clocks a must for your ham shack. Choose from a dual clock that displays UTC and local time or the single unit that displays 24 hour time.

Mounted in a brushed aluminum frame, these clocks feature 5/8 inch LCD numerals and a sloped face for easy across the room reading. Both also feature easy set month, day, hour, minute and second functions that can be operated in an alternating time-date display mode. MFJ-108, 4½x1x2 inches; MFJ-107, 2¼x1x2 inches. Battery included.

MFJ-962B VERSA TUNER III

MFJ-962B $229.95

Run up to 1.5KW PEP and match any feedline continuously from 1.8 to 30 MHz: coax, balanced line or random wire.

Lighted Cross-needle Meter reads SWR, forward and reflected power in one glance. Has 200 and 2000 watt ranges. 6 position antenna switch handles 2 coax lines, random wire and balanced lines. 4:1 balun. 250 pf, 6 kv variable capacitors. 12 position ceramic inductor switch. Smaller size matches new rigs: 10¾ x 4½ x 14 7/8 inches. Flip stand for easy viewing. Requires 12V for light.

MFJ RANDOM WIRE TUNER

MFJ ANTENNA TUNER

MFJ-16010
$39.95

MFJ's ultra compact 200 watt random wire tuner lets you operate all bands anywhere with any transceiver using a random wire. Great for apartment, motel, camping. Tunes 1.8-30 MHz. 2x3x4 inches.

REMOTE ACTIVE ANTENNA

54 inch remote active antenna mounts outdoor away from electrical noise for maximum signal and minumum noise pickup. Often outperforms long-wire hundreds of feet long. Mount anywhere-atop houses, buildings, balconies, apartments, ships. **Use with any radio** to receive strong clear signals from all over the world. 50 KHz to 30 MHz. High dynamic range eliminates intermodulation. Inside control unit has 20 dB attenuator, gain control. Switch 2 receivers and auxiliary or active antenna. "On" LED. 6 x 2 x 5 in. 50 ft. coax. 12 VDC or 110 VAC with MFJ-1312, $9.95.

MFJ-1024
$129.95

CROSS-NEEDLE SWR/WATTMETER

MFJ-815
$59.95

MFJ's cross-needle SWR/Wattmeter gives you SWR, forward and reflected power -- all at a single glance! SWR is automatically computed -- no controls to adjust. Easy-to-use push buttons select three power ranges that give you QRP to full legal limit power readings. Reads 20/200/2000 W forward, 5/50/500 W reflected and 1:1 to 1:5 SWR on easy-to-read two color scale. Lighted meter needs 12 V. ±10% full scale accuracy. 6½x3¼x4½ inches.

COMPACT SPEAKER

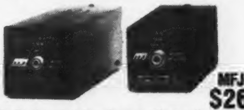
MFJ-280 $18.95

Mobile speaker. Tilt bracket on magnetic base. 3½ mm phone plug. Use with 8 and 4 ohm impedances. Handles 3 watts audio.

HANDHELD TELESCOPING ANTENNAS WITH BNC

MFJ-1710, $9.95, 3/8 wave 2 meter. Pocket clip. 5¾" - 24½".
MFJ-1712, $14.95, ¼ wave 2 meter; 5/8 wave 440 MHz, 7¼" - 19".
MFJ-1714, $16.95, ½ wave 2 meter. End-fed halfwave dipole. Shorter, lighter, more gain, less stress than 5/8 wave mounted on handheld. When collapsed it performs like rubber duck.

MFJ "DRY" DUMMY LOADS



MFJ-262
$64.95

MFJ-260
$26.95

MFJ's "Dry" dummy loads are air cooled -- no messy oil. Just right for tests and fast tune up. Non-inductive 50 ohm resistor with SO-239. Full load to 30 seconds, de-rating curve to 5 minutes. **MFJ-260 (300 watt),** SWR 1.1:1,1-30 MHz, 1.5:1, 30-160 MHz, 2½x2½x7 inches. **MFJ-262 (1 KW),** SWR 1.5:1,30-160 MHz. 3x3x13 in. Alum. housing.

MFJ DELUXE ELECTRONIC KEYER

MFJ-407B
$69.95

MFJ-407B Deluxe Electronic Keyer sends iambic, automatic, semi-auto. or manual. Use squeeze, single lever or straight key. Plus/minus keying. 8-50 WPM. Speed, weight, tone, volume controls. On/Off. Tune. Semi-auto switches. Speaker. RF proof. 7x2x6 inches. Uses 9 V battery. 6-9 VDC or 110 VAC with AC adapter, MFJ-1305, $9.95.

ANTENNA CURRENT PROBE

MFJ-206 $79.95

MFJ Antenna Current Probe lets you monitor RF antenna currents -- no connections needed! Determine current distribution, RF radiation pattern and polarization of antennas, transmission lines, ground leads, building wiring, guy wires and enclosures.

- **Determine if ground** system is effective.
- **Pinpoint RF leakage** in shielded enclosures.
- **Locate best place** for mobile antenna.
- **Use** as tuned field strength meter.
- **Indicate transmission line radiation** due to high SWR, poor shielding, antenna unbalance.
- **Detect re-radiation** from gutters, guy wires that can distort antenna field patterns.

Monitors RF current. 1.8-30 MHz. Has sensitivity, bandswitch, tune controls, telescoping antenna for field strength meter. 4x2x2 inches.

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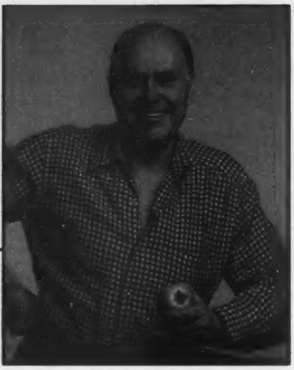

ARE WE HAVING FUN YET?

Okay, what's the most fun you remember having in amateur radio? This is a hobby, in case you've lost perspective—it's supposed to be fun. Indeed, if the darned hobby isn't fun you'll probably fade away even before smoking, fat or too many 807s get the ARRL to issue you their final and most coveted award, your "silent key" certificate.

The word I have from a reliable source within the League is that the next "world" is made up of anti-matter, with the result that radio uses negative frequencies. Our positive frequencies can be heard weakly reflecting through when conditions are just right, but the signals from "the other side" are so weak they just add some background QRM to our pileups and few ever get through. That may not seem fair, but if you stop and consider all of the rotten things you've done, perhaps you'll agree this is well warranted.

Hey, don't look at me with that innocent look, I've been around this crummy hobby long enough so I've heard you out there. I've heard you kerchunking repeaters. I've heard you jamming the service nets. Even worse, I've heard you in DX pileups intentionally and illegally interfering with your fellow amateurs. I've heard your bad language—your fatuous remarks—your calling CQ without checking the frequency—tuning up your rig on the air instead of into a dummy load. No, you're guilty and probably need a few years of come-uppance so you'll be a better person when your spirit is recycled.

Yes, I've seen you at your ham club making life miserable for any Novice who dares to come to a meeting—I've seen you at the flea markets looking for some poor sucker selling a rig who doesn't know what it's really worth—and I've seen you pawning off hopeless gear as "like new" at the same flea markets. Shameless.

You think I don't know what you were doing when you were a kid in your hamshack while your peers were out dating? I wouldn't wonder that Hiram Percy Maxim will personally be waiting to sign your Silent Key certificate and issue you a spark transmitter with welded key contacts.

No amount of church-going or religious contributions are going to absolve you from your sordid ham past. Not even political contributions will get you out of this one. No, you sinner, the only way you can repent and have even a ghost of a chance at absolution is to get started immediately Elmering teenagers into the hobby—and proselytizing for a no-code ticket. I'm talking fanatic now, not lip service.

It's too late to drop out of the hobby and hope Hiram won't notice as you try to slink by him, hiding your Silent Key certificate. No, once you got your ham ticket you accepted the responsibility to productively use the billions of dollars of radio frequencies reserved for hams.

Oh yes, I was asking about fun. Hamming has got to be fun if we're going to help it survive. So what's ham fun for you? Is it using your ten kilowatts to grind those low power turkeys into the noise level? Or do you get your enjoyment helping others work a rare one by offering to run a list? Are you handling QSLs for some rare one, making hamming a tad more fun for him? Are you getting your kicks from Elmering youngsters? Perhaps you're running a repeater which is making hamming more fun for dozens?

I've been hanging around 20m lately, but DX has been slow, so almost every contact I've had has been with a retired person without much to talk about. That gets old fast.

The early days of repeaters were fun. I used to drive to the top of Pack Monadnock, about three miles from home, and see who I could work from there. On good nights I was able to work New York City—and occasionally

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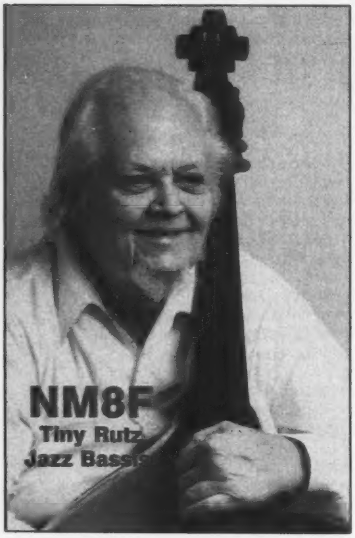

QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, WGE Center, 70 Rte. 202 N., Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

QRM

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New
220 MHz

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pacesetter in Amateur Radio

220: FM for All!

ENWOO
WD6DJY

Kenwood brings you a wide range of 220 MHz gear designed for every need. Choose from two types of mobile and two types of HT. The TH-315A is a full-featured HT covering 220–225 MHz. Ten memory channels and 2.5 watts of power. (5 W with PB-1 or 12 V DC.) Uses the same accessories as the TH-215A for 2 meters or TH-415A 440 MHz. For truly "pocket portability," choose the TH-31BT, a thumb-wheel programmable, 1 watt unit. For mobile use, select the TM-321A or TM-3530A.

The TM-321A is the 25 W, 220 MHz, 14-channel version of the super popular, super compact TM-221A. The 25-watt TM-3530A has 23 channels, a 15 telephone number memory and auto dialer. Direct keyboard frequency entry and front panel DTMF pad enhances operating convenience. Novice to Amateur Extra, these transceivers will put everyone on the air "Kenwood Style."!

TH-315A
Full-featured HT
TM-321A
Compact mobile transceiver
New
TH-31BT
Pocket-held HT
KENWOOD
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4.980
New

TM-3530A
Full-featured mobile transceiver

A complete line of accessories is available for all models.

Complete service manuals are available for all Kenwood transceivers and most accessories. Specifications and prices are subject to change without notice or obligation.

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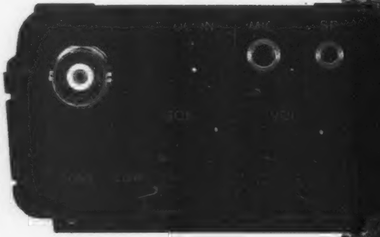
220 MHz
TH-315A
Here Now!

This HT Has it All!

TH-215A/315A/415A

Full-featured Hand-held Transceivers



Kenwood brings you the greatest hand-held transceiver ever! More than just "big rig performance," the new TH-215A for 2 m, TH-315A for 220 MHz, and TH-415A for 70 cm pack the most features and the best performance in a handy size. And our full line of accessories will let you go from hamshack to portable to mobile with the greatest of ease!

- **Wide receiver frequency range.** Receives from 141-163 MHz. Includes the weather channels! Transmit from 144-148 MHz. Modifiable to cover 141-151 MHz (MARS or CAP permit required).
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- **Odd split, any freqency TX or RX, in memory channel "0."**
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- **Intelligent 2-way battery saver circuit extends battery life.** Two battery-saver modes to choose, with power saver ratio selection.
- **Easy memory recall.** Simply press the channel number!
- **12 VDC input terminal for direct mobile or base station supply operation.** When 12 volts applied, RF output is 5 W! (Cable supplied!)
- **New Twist-Lok Positive-Connect™ locking battery case.**
- **Priority alert function.**
- **Monitor switch to defeat squelch.** Used to check the frequency when CTCSS encode/decode is used or when squelch is on.
- **Large, easy-to-read multi-function LCD display with night light.**
- **Audible beeper to confirm keypad operation.** The beeper has a unique tone for each key. DTMF monitor also included.
- **Supplied accessories:** Belt hook, rubber flex antenna, PB-2 standard NiCd battery pack (for 2.5 W operation), wall charger, DC cable, dust caps.

Optional Accessories:
• PB-1: 12 V, 800 mAH NiCd pack for 5 W output • PB-2: 8.4 V, 500 mAH NiCd pack (2.5 W output) • PB-3: 7.2 V, 800 mAH NiCd pack (1.5 W output) • PB-4: 7.2 V, 1600 mAH NiCd pack (1.5 W output) • BT-5 AA cell manganese/alkaline battery case • BC-7 rapid charger for PB-1, 2, 3, or 4 • BC-8 compact battery charger • SMC-30 speaker microphone • SC-12, 13 soft cases • RA-3, 5 telescoping antennas • RA-8B StubbyDuk antenna • TSU-4 CTCSS decode unit • VB-2530: 2m, 25 W amplifier (1-4 W input) • LH-4, 5 leather cases • MB-4 mobile bracket • BH-5 swivel mount • PG-2V extra DC cable • PG-3D cigarette lighter cord with filter

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QRX . . .

EDITED BY BRYAN HASTINGS KA1HY

Celestial PBBS

THE LONG-AWAITED BULLETIN BOARD SYSTEM OF FUJI OSCAR-12 has been successfully loaded and is apparently functioning well. It is estimated that in its first few days of operation, over a hundred messages have been posted and received. This comes after more than ten months of hard work in overcoming earlier software problems and constraints on use imposed by a tighter-than-expected power budget. The software was finally loaded by JAMSAT technicians at 0440 UTC on June 21.

The experimental mailbox software Version 1.0 has some limitations, and is slightly different from the descriptions given in *QST* and *ASR*. Version 1.0 of the mailbox program has the following commands:

F : List latest 10 message headers with message number
F* : List all the message headers
Rn> : Read a message numbered n>
W : Send a message. You will be asked receiver and subject. Send CR>. CR> or CR> Z CR> to end the message.
K n> : Kill a message numbered n>. A message being read by other station(s) cannot be killed. FO-12 BBS is a multi-user system. Only originator of the message can kill messages.
H : Help

Your TNC should be set for the following parameters:

Protocol : Version 2 WA8DED PROMs needed for TNC-1.
Command TNC-1 : V2
TNC-2 : Ax2512 v2 ON

T1 Timer : 6 seconds or longer
Command TNC-1 : F6
TNC-2 : FRack 6

Max Frames : 2 or 3 is suggested
Command TNC-1 : 02 or 03
TNC-2 : MAX 2 or MAX 3

The callsign of FO-12 which you use to connect is 8J1JAS. There is no logout command; simply disconnect using the TNC's disconnect command. No personal mail is supported by the first version.

Good luck on using the first satellite PBBS!

RS-10 and RS-11 Launch

THE LAUNCH IN LATE JUNE OF THE SOVIET UNION'S LATEST AMATEUR RADIO SATELLITES went off without a hitch, and so far have been doing well. The RS-10 and the RS-11 appear to be identical except for their frequency use. Both use five modes (K, T, A, KT, KA). Uplinks are 15m and 2m; and downlinks are on 10m and 2m.

JY1 Diplomacy

HIS MAJESTY KING HUSSEIN JY1 OF JORDAN HAS BROKEN THE ICE with communications with Israel, although not officially. The Radio Society of Great Britain reported that the event occurred on April 18th when His Majesty paid an impromptu visit to a British amateur, Ed Benou G0BBD, in Middlesex, England.

During his visit, the King, using his UK callsign G0DEY/JY1, made numerous contacts on 20m SSB—most with Israeli hams! These contacts occurred in the week of the Jewish Passover celebration, and the King took the opportunity to extend his Passover greetings to the Israeli hams. Kol Israel, the country's international shortwave service reported: "Once again, the amateur radio shortwave bands have been used in a most striking fashion to display international goodwill."

This event is significant because there are no amateur radio exchanges permitted between Israel and the surrounding Arab countries, except Egypt. Perhaps this notable gesture of goodwill will help in freeing these restrictions.

Stock in AR

WILLIAM HIGGINS WA2RXQ, A MEMBER OF THE NEW YORK STOCK EXCHANGE, designed a mobile phone unit which allows him to do what normally isn't done—talk with customers directly from the NYSE's floor, and trade stocks for them. Up until now, phone links to the floor (of which there are 7,000) have been linked only to the trading rooms of member firms. This is in accordance with the policy of the Big Board forbidding nonmembers of the Exchange, such as brokers' clients, from having direct access to the floor.

Higgins explains that his mobile communications allows him to give his clients better service, and gives independent brokers a weapon to compete with the powerful trading houses. Big Board officials see it differently, contending that Higgins is giving his costumers an unfair advantage over investors who can deal only with off-floor brokers, and so have fought against his right to have a phone on the floor since 1980. Sixty-thousand

SCCA
CS
73 MAGAZINE

Bob Lucas WA0DXZ/5 in the 73 Magazine *Dodge GLH Turbo autocross car in Albuquerque NM. The co-driver Marlene Ellis KA5WXM took the photo. They had just run the SCCA Rocky Mountain Solo II championships on June 13–14, and placed fifth in the event.*

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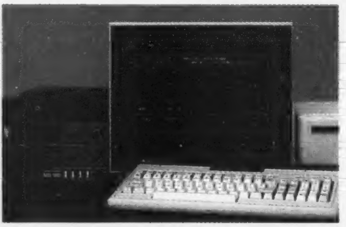
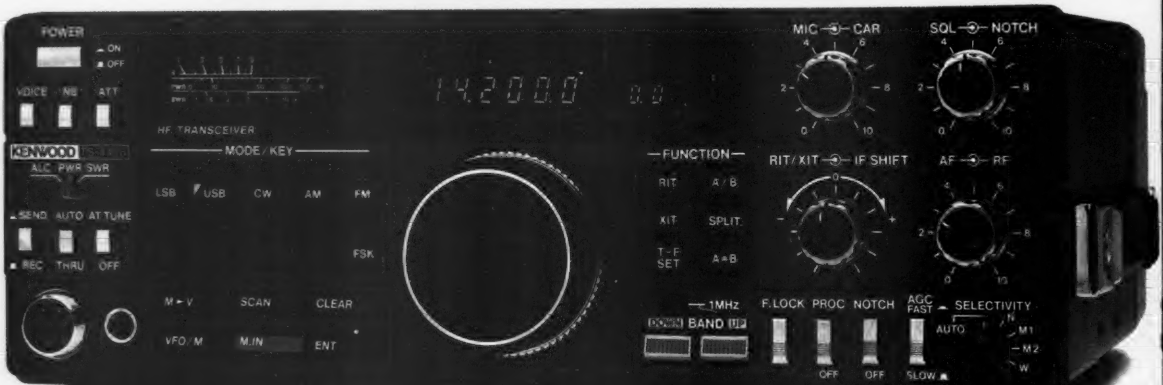
TS-440S Compact high performance HF transceiver with general coverage receiver

Kenwood's advanced digital know-how brings Amateurs world-wide "big-rig" performance in a compact package. We call it "Digital DX-citement"—that special feeling you get every time you turn the power on!

- **Covers All Amateur bands**
  General coverage receiver tunes from 100 kHz–30 MHz. Easily modified for HF MARS operation.
- **Direct keyboard entry of frequency**
- **All modes built-in**
  USB, LSB, CW, AM, FM, and AFSK. Mode selection is verified in Morse Code.
- **Built-in automatic antenna tuner (optional)**
  Covers 80-10 meters.
- **VS-1 voice synthesizer (optional)**
- **Superior receiver dynamic range**
  Kenwood DynaMix™ high sensitivity direct mixing system ensures true 102 dB receiver dynamic range. (500 Hz bandwidth on 20 m)
- **100% duty cycle transmitter**
  Super efficient cooling permits continuous key-down for periods exceeding one hour. RF input power is rated at 200 W PEP on SSB, 200 W DC on CW, AFSK, FM, and 110 W DC AM. (The PS-50 power supply is needed for continuous duty.)
- **Adjustable dial torque**
- **100 memory channels**
  Frequency and mode may be stored in 10 groups of 10 channels each. Split frequencies may be stored in 10 channels for repeater operation.
- **TU-8 CTCSS unit (optional)**
  Subtone is memorized when TU-8 is installed.
- **Superb interference reduction**
  IF shift, tuneable notch filter, noise blanker, all-mode squelch, RF attenuator, RIT/XIT, and optional filters fight QRM.
- **MC-43S UP/DOWN mic. included**
- **Computer interface port**
- **5 IF filter functions**
- **Dual SSB IF filtering**
  A built-in SSB filter is standard. When an optional SSB filter (YK-88S or YK-88SN) is installed, **dual** filtering is provided.
- **VOX, full or semi break-in CW**
- **AMTOR compatible**





Optional accessories:
- AT-440 internal auto. antenna tuner (80 m–10 m)
- AT-250 external auto. tuner (160 m–10 m)
- AT-130 compact mobile antenna tuner (160 m–10 m)
- IF-232C/IC-10 level translator and modem IC kit
- PS-50 heavy duty power supply
- PS-430/PS-30 DC power supply
- SP-430 external speaker
- MB-430 mobile mounting bracket
- YK-88C/88CN 500 Hz/270 Hz CW filters
- YK-88S/88SN 2.4 kHz/1.8 kHz SSB filters
- MC-60A/80/85 desk microphones
- MC-55 (8P) mobile microphone
- HS-5/6/7 headphones
- SP-40/50B mobile speakers
- MA-5/VP-1 HF 5 band mobile helical antenna and bumper mount
- TL-922A 2 kw PEP linear amplifier
- SM-220 station monitor
- VS-1 voice synthesizer
- SW-100A/200A/2000 SWR/power meters
- TU-8 CTCSS tone unit
- PG-2S extra DC cable.

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dollars in legal fees later, Higgins had his right to a phone on the floor confirmed, setting a precedent which has inspired other independent brokers to go after their own institutions.

First DA Ham Contact?

ON JULY 15, JERRY TURPIN N4IMU (now AB4CT) and Art Ogden N4HAN, made 2-way digital audio contact on 145.09 MHz using packet to transmit the digital signals. Their speech was sampled 4000 times/second, giving it a fidelity of about 2000 Hz, making it communications-grade audio. One drawback they encountered was that, given such a high sampling rate and low sending rate (1200 baud), one second of speech has a delay of about ten seconds. Jerry is working on a program to reduce the sampling rate by looking for repeating units in speech—such as pauses—in order to make contacts more real-time.

Radio Shack in Amateur Radio

THE FLOOD OF NEW NOVICES resulting from Novice Enhancement has spurred the Tandy Corporation, which operates 8,500 Radio Shack stores worldwide, into joining the Amateur Radio market. Once it became apparent to the Vice President of Consumer Products Merchandising, Robert Miller, (a new ham), that the Commission would be approving Novice Enhancement, he arranged for Gordon West WB6NOA and Fred Maia W5YI to prepare a Novice Package for the Radio Shack chain. This package became available in August.

We look forward to Radio Shack's increasing involvement in the Ham market.

East-West Launch

AS EARLY AS FIVE YEARS FROM NOW, the Soviet Union may begin to launch western-built OSCARs, according to representatives of several AMSAT national organizations, including Dr. Andras Gschwindt HA5WH. HA5HW, the IARU Region 1 satellite coordinator, was interviewed for the international shortwave broadcast "Media Network", which airs on Radio Netherlands. In the interview with program producer/host Jonathan Marks G8WGN, Gschwindt said that "the first step have been taken to arrange a launch of a Soviet rocket with a western-made satellite aboard, sometime around 1990."

Arrgh!

Just *what* is that annoying staccato transmission which ranges along the HF bands at times, drowning out all contacts? Here's some info on the too-familiar Russian Woodpecker. . .

There are three large over-the-horizon back-scatter (OTH-B) radar systems in the Soviet Union. One is located near Nikolayevsk-na-Amurye in extreme eastern Siberia, another near Nikolayevsk in the Caucasus mountains, and a third near Gomel, about 175 miles southeast of Minsk. The first and last are directed at U.S. ICBM fields, and can provide up to an half-hour warning of a strike launched from the U.S. They can also detect U.S. planes. The third OTH-B radar system is directed southeast to provide warning of a Chinese ICBM strike. The transmissions are extremely powerful—40 megawatts and more—and range across the HF band from 4 to about 27 MHz, depending on the ionospheric conditions. At dawn, they generally appear at 14 MHz and below, often around 14.215 MHz. The signals move up and down this band segment in 10 kHz steps at intervals of 30 seconds to ten minutes. The bandwidth varies from 30 kHz to more than 300 kHz. The Woodpecker has a basic pulse repetition frequency (PRF) of ten per second.

VEC Meeting

THE QUESTION POOLS used to test candidates for new or upgraded amateur licenses will be revised only every three years, and VECs will petition the FCC to return to the old rules governing code tests. These were the two main decisions of the VEC meeting held July 11 at the ARRL National Convention in Atlanta. The previous rules for the code tests stated that telegraphy tests "may" and not necessarily "shall" contain all required letters, numbers, and certain punctuation and operating procedure signs.

Pirate Net

IN LATE JUNE, the FCC, on a lead from *Westlink*, shut down a pirate radio network in the Los Angeles area. It turns out that the group had been operating an FM repeater near the 11m CB band, and there is evidence that there were *200–300* members in the group. *Monitoring Times* reports that "crossband inputs to the repeater included out-of-band CB frequencies, cordless telephone channels, and even the unallocated frequencies between UHF general mobile radio service channels"

Most of the inputs used tone squelch, and the FCC confirmed to the press that the primary repeater location for the network was atop the Palos Verdes peninsula, just south of Los Angeles. It's not known whether hams were involved in this network; the FCC did not identify any of the busted members as hams in their release to the press. The FCC in San Diego also says that it is coming down hard on a number of businesses which have been selling illegally modified radios and CB linears in California and Arizona.

PRB-3

IF THE FCC decides to farm out the issuing of secondary and special amateur radio callsigns, the ARRL won't be alone in asking to take on the project. Forrest Industries Telecommunications of Eugene, Oregon filed comments with the FCC asking to be named as a special callsign coordinator if the terms of PRB-3 are approved.

Also wanting to be SCSCs are: *Callbook Magazine*, Buckmaster Publishing, The Central Alabama VEC Inc., the Sunnyvale VEC-Callsign Inc., Fred Maia W5YI, and others, including at least two or three reported requests from non-U.S. companies and individuals.

Polar Trek

COMMUNICATIONS WITH AMATEUR RADIO SATELLITES as well as the internationally operated Sarsat/Cospas satellites will be a vital part of a joint Russian/Canadian polar skiing expedition next February according to PA0DLO and G3IOR. Leonid Labutin UA3CR, a well-known polar explorer and Radio Sputnik proponent, will be part of the group of Russian and Canadian scientists venturing across the pole late next winter.

Voice and data communications may be employed on the satellites. A new hand-held satellite communications transceiver was recently demonstrated in a March issue of Soviyetskaya Rossiya. It is believed to be a low-speed data (perhaps packet) communications system that could probably be used with RS-9 after it is launched. According to G3YJO, there have been preliminary discussions about carrying a UO-11 DCE station with the expedition.

PRB-3 Update

THE FCC JUST RECENTLY CLOSED PRB-3, the vehicle for receiving proposals from the private sector on privatizing the issuance of specific callsigns in the Amateur Radio Service. The FCC is now considering these proposals, and it is expected that the Amateur Radio community will be able to select a specific callsign early next year. The FCC suggested a cost of $10–$100 for each selected call. Thanks to Fred Maia W5YI for this update.

Articles

Keep those articles coming in! Get your great ideas in print and get paid for it to boot. *73 Magazine* pays the most in the market for publishable materials.

Credits

Thanks to *Business Week, Westlink, W5YI Report, LCARA*, N4IMU, and WA0DXZ/5 for this month's news pieces. Send your news items to *73 Magazine*, WGE Center, 70 Rt 202 N., Peterborough NH 03458-1194; Attn: QRX

LETTERS

HANGING IN THERE

As a prospective amateur radio operator, I just wanted to let you know how much I enjoy your magazine. It surpasses by far any other publications in its class, such as *Radio Electronics* and *CQ*. I find (Wayne's) editorials quite amusing and a major factor to the success of your magazine.

One thing that troubles me is the type of people that this hobby attracts. Being a prospective operator, I figured a good place to find out about my hobby was the ARRL in Newington; boy was I wrong! All three times I went there, I was greeted by a receptionist filing her nails. I decided to purchase one of their publications—the look she gave me could have sent a chill down the spine of a desert rodent.

I have attended several Hamfests in the New England area. Never before did I see so many con men in one place. I made the mistake of mentioning I did not have my license, and you would not believe some of the junk I was being peddled. If a piece of equipment is brand new, then why are there scratch marks where the covers have been removed more times then I care to know about?

Just walking around, I listened to some of the hams talking. Most of it was about who had the biggest antenna or the most powerful rig. I approached a couple of hams hoping to find some support or guidance but was greeted coldly, like I was invading some big secret.

I am not implying all hams are bad. I found someone to help me who happens to live only two miles away. Help is always closer than you think! So, I am relying on the good hams, your magazine, and the many books I have purchased, to learn the interesting hobby of amateur radio.

Call me discouraged, but not a quitter!

Kevin Romanic
Tolland CT

Kevin, I hope you caught the gal at HQ on bad days - sounds like the workers in Russia! I've always been enthusiastically greeted at the League. I don't think you'll find New England has a corner on sharp trading at flea markets—no place for the unwary—they're called "thieves markets" in some areas... perhaps a more fitting name. Look for me on 20m.—Wayne

NOT WITHOUT REASON?

Well, on the off chance no one else congratulated you on your editorial in the April issue, I will. Every once and a while, someone really succeeds in putting really heavy thoughts on paper, and you did it that time. The critique of how establishment "hamdom" is failing to live up to the purpose of its franchise should rank with the Magna Carta and the Declaration of Independence. You hit the nail on the head so spectacularly that you might just have succeeded in ranking Wayne Green in the same league as Thomas Jefferson.

You analysed the problem in such a logical fashion that you had to have attracted the attention of the great silent majority. I predict the criticism from your corps of loyal detractors will probably be disappointingly mild, maybe even a total letdown.

I hope you continue to follow up on this editorial in your public appearances. By spreading the message and reinforcing the ideas of replacing good little "establishment hams" with people who have the brains and drive to begin the long overdue revitalization of Amateur Radio, we might succeed in reversing the downhill slide.

"Never Say Die" has been replaced with *"Non Sans Droit."*

Robert E. Brossman W8PMS
Wheeling WV

Thanks for taking the time to drop me a note—it's appreciated. Alas, I've found that many league members label any efforts to change the ARRL as attacks. I've never had any indication that they actually read or consider such ideas. Makes it difficult to bring about changes, no matter how desperately needed.—Wayne

LIKE YOUR STYLE

I have submitted a subscription order for *73 Amateur Radio* under separate cover and wanted to let you know why.

Quite honestly, I like your style. I haven't been a ham for very long, only since November of last year, but have formed some very definite opinions as to what is right and wrong with our hobby. After hearing you speak in Richfield, Minnesota, last year, reading a few issues of your magazine, and listening to other hams, I found that I agreed with you far more often than not. (I, for one, like *CW*).

There are almost no young people involved in what should be a hobby crawling with kids interested in computers and electronics. I was active on 2m repeaters in the Minneapolis/St. Paul area for six months earlier this year, and in that time I talked to a grand total of two hams still in high school. If I had to guess, I would say that one third to one half of my contacts were retirees. I'm 31 and from looking around at the testing sessions I have attended, think I'm fairly typical of today's new ham—when I should not be. We need to get kids excited and involved in radio and I like your ideas there.

With the exception of packet, there just isn't a lot of excitement in the ham community for radio technology. I want to see articles about hardware pioneers. I'm not much of a builder yet, but enjoy finding out how things work and how to put them together. I also enjoy reading about the satellite program, and am going to try it as soon as I can kludge together a station.

Most of all, I discovered long ago the value of playing devil's advocate as a way to get folks moving—by getting them mad, and you do it well! Keep up the good work.

Mark Hunn
Groton CT

Make people mad? Me? Baloney!—Wayne

A LITTLE MEANS MUCH

This letter is in response to the column "Never Say Die" appearing in the June issue of *73*.

I agree that English should be recognized as the foremost language of this country, and that a good command of English is a prerequisite to success. But you have down-played the value of English-speaking Americans learning a foreign language on the grounds that it's hard work and not immediately useful. If we only did what was easy, where would we be as a nation? As far as being useful, let me illustrate my point.

I am a software troubleshooter working for a California software firm. From time to time I speak with clients in French-speaking Canada, or in Latin America. I am fluent in neither French nor Spanish, but I do know a little of both. When I speak with a client whose English is not good, letting him know that I speak a little of his language, usually lets him loosen up and be more comfortable with English. That's aiding international communications!

As hams, we are all working in an international medium by choice. Let's recognize the international nature of radio and not be arrogant by demanding that those outside our borders speak English. Instead, we should encourage them to speak English by meeting them half way—by learning a bit of their native language.

Jeff Cauhape
Boulder Creek CA

MAS DESPACIO, POR FAVOR!

Shame on you for your comments on the use of English on amateur radio. I know a number of amateurs who have learned Spanish by practicing it on the air and had a lot of fun at the same time. Latin Americans appreciate it when someone takes the trouble to learn Spanish and they do not insist that the Spanish they are listening to be error-free. Most of the Spanish-speaking stations that one hears on the air, by the way, can speak English—at least enough to make a short QSO. Obviously, the same cannot be said for us Ws.

Rather than encourage your fellow amateurs to be smug in their isolation from the rest of the world, I should think you would encourage amateurs in the U.S. to open a new chapter in the use of our hobby by using it to learn another language. Japanese would be fine, too. How do you think Chip K7JA parlayed his knowledge of Japanese into a good job with Yaesu?

Partly due to communications, which we have helped to develop, the world is becoming a smaller place. No matter where people live in this world, they will be hearing more and more foreign languages spoken. Sen. Hayakawa's initiative, unfortunately, is an attempt to harken back to simpler times, times which will never return. The age of communications has made knowledge of foreign languages not only useful but probably necessary, in the future, if the United States is to hold its postion in the world.

Fred Laun K3ZO
American Embassy (USIS)
Nicaragua

Smug, Fred? Baloney! The more foreign amateurs learn English, the more business opportunities they will have. Of course it's good business for an American working in a foreign country or for a foreign employer here to know the language—but for the other 99.9% of us the time spent on a foreign language is wasted. This has nothing to do with chauvinism or American ego, it's just common sense . . . which I realize is an oxymoron—Wayne.

PACKET FROM BUENOS AIRES

Just read your July editorial, and couldn't agree with you more. Some of the new and exciting technologies seem to be completely overlooked by the amateur community.

Perhaps it's due to our over-dependance on Japanese equipment. Having visited Japan several years ago I came to realize that most, if not all the equipment which shows up on the American market, is nothing but warmed-over Japanese market gear adapted to U.S. standards and requirements. Nothing specific for the States seems to be coming out of Japan these days and yet in some areas, such as packet and computer interfacing, we're light years ahead.

You really touched a nerve when you asked about digital voice. The packet network has the potential to make amateur radio into a completely new hobby, and digital voice is the key.

The world is changing, and I'm afraid some of our co-hobbyists are still lamenting the demise of spark transmitters.

Keep up the good work.

Ken Price K2TIS/XE1TIS
Buenos Aires

PS: This is coming to you via packet-switching from Buenos Aires. When will the hams catch up with commercial operations?

HELPER BECOMES HELPEE

Recently one of the local hams found his ham ticket to be a real lifesaver. Mel Mc Dermott WB0AQS became a ham shortly after he retired. He has enjoyed QSOs with local hams, is active on HF, and is the real inspirational drive for our 10-meter Nut-Net which meets at 7:30 local time on 28.430 MHz daily.

Hams frequently are called upon to help with communications during times of emergency. Mel found himself in service during the Mexico City earthquake disaster.

Mel, who is seventy-eight years young, has had a bit of heart trouble lately, so when he began feeling ill while visiting Bud Nessler KB0QL, he thought it best to go home and lie down. On his way home, he decided that this time it was he who needed help. He called Bob Wagner W0YLQ on 2-meters to have an ambulance come to get him. Bob used the local autopatch to reach the 911 emergency number. Meanwhile Mel blacked out, and his foot slipped off the brake pedal. His car rolled backwards down the street, jumped the curb, crossed the sidewalk, rolled through some shrubbery, and came to rest against a house.

Another ham who lived in the vicinity was monitoring the frequency and decided to go to Mel's aid. He hopped on his bicycle and arrived at the reported corner about the same time as the ambulance. Mel could not be found since his car was fairly well hidden by the shrubbery. Mel eventually awakened and could see the ambulance and Bob from his spot. Once again he used his 2-meter rig. This time it was to contact Bob and let them know where he was.

Mel had to have a pacemaker installed in his chest. Although at first he was a little concerned that his hamming might come to an end if his radio were to interfere with his pacemaker, after a checkup with and without the radio he was told he could operate his radio—although he cannot operate his car.

It is very comforting to know that there are countless hams who are willing to help people in distress. It is a terrific hobby, and it is people like them who make me proud to be a ham.

Mike Jozefowicz NS0U
Dubuque IA

CODE IS FUN

Several years ago, I wrote a letter saying that the only reason I couldn't get my Novice license was that the code was designed as an insurmountable barrier to keep me out. I complained that I couldn't get any help learning the code from the Hams in this area.

Well, I want you to know that I not only passed my Novice test, but two days later I also passed my Tech. Now I don't want you to think I did this by myself. I had a lot of help and would like you to publish this letter to encourage other hams to help Novices.

I have changed my opinion about the code in that I now think code is fun. But I still don't think that code should be a part of the requirements for a license. After all you don't have to memorize Baudot or ASCII to qualify for a license. I was already a CET and I hardly had trouble with the written test.

Rick C. Wilson
Chattanooga TN

MOVING ALONG

A few comments on the current state of affairs on the ham bands—perhaps we should call them gripes. I feel that awareness might suppress some of the problems I find through my own operating.

As I work mostly 40 CW from the mobile, QRM is not much of a problem. The band is too little used for that. It does appear that QRN is a very serious problem for more than a few of us. In recent months, I have been unable to finish several contacts due to the claim of the other operator that goes like this: SRI OM-MISSED ALL-BAD QRN-73. This seems to happen shortly after I have answered the other fellow's CQ.

I realize a mobile signal will be a bit weaker than with a big skyhook in the back yard. I usually get decent reports, in keeping with band conditions and such, so I pretty much know that if I hear a guy 579, he should have no problem with me. So when a guy gives me a 579, then tells me he has QRN too bad to hear me, I wonder why this guy even called CQ.

Another problem is CW ops who cannot copy. Did you ever hear a call like KE2PXM2? How about KE2PCM2? Hey fellas, either you are not paying attention (thus not really interested in who or what you are working and should be in front of the tube), or your code readers are broken, or I cannot

Continued on page 77

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Wayne Green Enterprises is a division of International Data Group.

73 Amateur Radio (ISSN 0745-080X) is published monthly by WGE Publishing, Inc., a division of Wayne Green Enterprises, Inc., WGE Center, Peterborough NH 03458-1194.

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ICOM IC-761

ICOM America, Inc.
2380-116th Ave. NE
Bellevue WA 98004
Price Class $2499

by Bill Clarke WA4BLC

> *"Give me the luxuries of life and I will willingly do without the necessities."*
>
> **Frank Lloyd Wright**

ICOM's IC-761 is the latest HF entry from the Land of the Rising Sun. It is a fully solid state, digital displayed, highly sophisticated radio communications device. I know those are not words normally used to describe a piece of ham radio equipment, but the 761 is no plain piece of ham radio gear. It is the most precision-crafted and complete ham transceiver from ICOM to date.

First Impressions

The IC-761 is larger than the Kenwood TS-940, and is black. It is solid in appearance and feel, with a formidable 69-control front panel. It rounds itself out with memory functions, a built-in antenna tuner, full break-in keying, electronic keyer, and high-stability crystal unit. Naturally, the 761 can be used as a very effective short wave receiver. It can also be remotely controlled by computer via an RS-232C/serial-port connection.

The instruction manual that comes with the 761 is the best laid out manual I have seen in several years. Replete with pictures, diagrams, and easy-to-understand explanations of each individual control, it is as much state of the art as is the transceiver itself.

Operating Impressions

With a rig as sophisticated and complicated as this one, I needed to completely review the manual before any on-the-air operation was done.

The smooth weighty feel of the tuning dial is impressive (and adjustable) giving the feeling of total control. This is a welcome improvement over other manufacturer's radios. The digital readout is very nice, with no background flicker during tuning, and easy-to-read large blue numbers. Additionally, the memory numbers (and some of the other information that appears on the display) are in red. No confusion here.

I do wish, however, that there was 10 Hz readout. This is available by switch selection (or internal modification) on many other contemporary HF transceivers.

The tuning rate is adjustable from 5 to 500 kHz per turn. Under ordinary circumstances the user will be tuning at the rate of 5 kHz per turn of the dial. If the dial is turned at a fast rate, the tuning rate picks up to 25 kHz per turn. If the TS button is pushed, you clip along at 500 kHz per turn. I thought this was a change from some of the earlier ICOM transceivers, so I did some checking. The 751A tunes at 2 kHz per turn in slow speed, and the venerable 730 tunes at 1 kHz per turn. I like the slower tuning rates better; however, the large tuning dial of the 761 makes for easy tuning.

Photo 1. Front panel of the IC-761.

The digital keypad, used for direct frequency entry, has excellent tactile and audio feedback. You push a button, and know you did, not think you did.

With the advent of all the solid state radios over the past few years, I think everyone knows all about passband tuning and i-f shift. The 761 has both, and they perform as expected. They share a common control that is detented for the zero point. In addition to these tunable receive features, there is a filter switch that allows switching to alternate filter schemes.

The memory feature is particularly nice in that when a memory frequency is selected, you can immediately tune away from it by turning the main tuning dial. To return, merely push the MEMO button.

The notch filter works very well, allowing easy night operation on 40 meters. It is a deep notch, however; very sensitive to tuning.

I tuned in the local country-western station on AM and listened to it. The audio quality was excellent. It makes a nice change after you've been in a few pileups with the Saturday afternoon kilowatt bunch.

The quality of the receive audio from the built-in speaker compares favorably with my main station speaker. It is not tinny sounding. There is a tone control for base and treble. There is not a large amount of variation, but enough to make a light voice sound more authoritative.

The receiver is very quiet, and doesn't get overly excited by summer static. Background noise is almost nonexistent. I found the noise blanker capable of removing offensive woodpeckers and the garbage caused by a faulty florescent light in my laundry room.

Scanning is possible, with several modes to select from. I found that scanning the 10-meter band was profitable when checking to see if the band was open and when looking for beacons. It was easy to scan the memories for activity on any of the several nets I operate on.

Transmitter

The 761 has two VFOs—really handy for working SSB splits. For CW splits, you can normally get by with the use of RIT (transmit). Split-band operation is possible with the 761.

The 761 is easily modifiable for use on oddball MARS frequencies, although many can be reached with the factory set up.

The keyer behaved wonderfully, and QSK is where it's at for the CW operators. I could find no fault when operating QSK, and could be broken with single dit. The note was approved of by all.

The monitor feature is a great adjunct when setting up your compression levels or testing various mikes for tonal qualities. Just put on the headphones and listen to your own voice.

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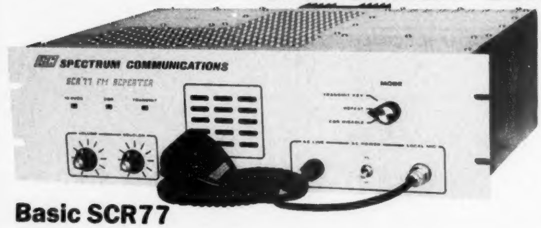

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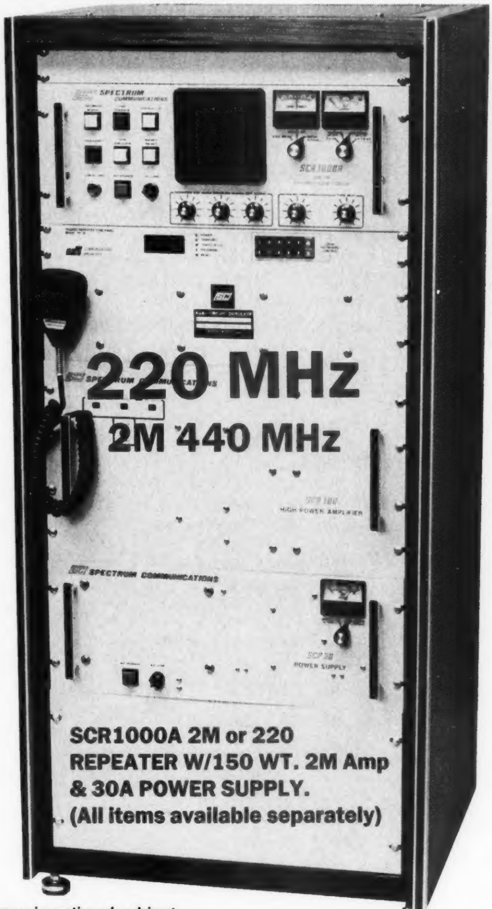

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It's also possible to vary transmitted voice tones with a pot inside the 761. The pot can be preset to highlight highs or lows, at your choice.

The audio reports I received were interesting. Most indicated I had excellent audio, a couple stated I was overdriving the rig. Several contacts asked what amplifier I was running. Just remember, audio reports vary with the receiving operator's hearing and preference. Reports from stations knowing my voice were all positive.

The built-in antenna tuner got a poor workout here, as my antenna system is pretty well peaked up. However, I was able to give it a test on 80 CW by using the 75 phone antenna. It took only 2 to 3 seconds for the automatic tuner to do its work, and I was on the air again.

The relay used to key linear amplifiers is a little anemic. I recommend the use of an external keying relay. ICOM is not alone with this problem. I recommend an external relay for most of the current transceivers.

Contrary to popular belief, a failure of the lithium memory backup battery will not place the entire transceiver off the air. It will only mean you cannot save and recall frequencies. Replacement does not appear to be a complicated matter.

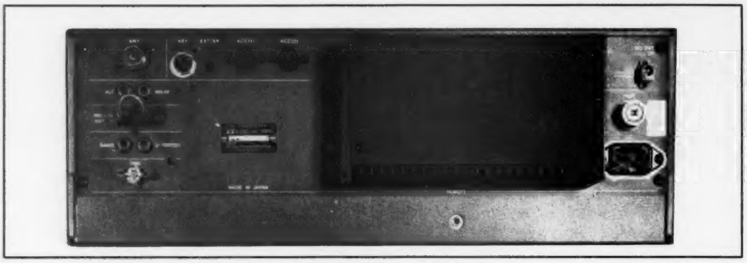

Photo 2. Rear panel of the IC-761.

Bench Testing

Bench testing is the only true method of measuring performance of any of the currently available amateur transceivers. I feel that all of them are capable of performing above and beyond the capabilities of the human ear, and certainly over the poor band conditions we often experience.

The following equipment was used in checking the performance of the IC-761:

Leader LDC 8243 Frequency Counter
Marconi Instruments 2022 Signal Generator
Hewlett Packard 606 HF Signal Generator
Hewlett Packard 651A Audio Generator
Bird 43 Wattmeter
Hewlett Packard 8551B/851B Spectrum Analyzer
Cushman CE-5 Monitor
Tectronics 475 Oscilloscope

The specificatons and test results of the rig are shown in the sidebar.

I could find no fault with bench operation of the 761, and found no place where the advertised specifications were not met or exceeded. Again, the rig is capable of outperforming many ears and conditions.

Wrap Up

Not all the features of the IC-761 (or any other top of the line transceiver) will be of use to all operators, nor will the price be acceptable to everyone. However, feature for feature, the IC-761 is a most capable piece of equipment and is real competition for other top of the line transceivers. With the exception of the few faults I indicated in my observations, I feel comfortable in recommending the 761 as a good piece of equipment, albeit a little rough on the wallet.

Thanks to the folks at the Electronic Equipment Bank of Vienna, VA, for the loan of the IC-761, and the use of their very complete test bench. ■

SPECIFICATIONS

Frequency Coverage

Receive:	0.1 MHz–30.0 MHz
Transmit:	1.8–2.0
	3.45–4.1
	6.95–7.5
	9.95–10.5
	13.95–14.5
	17.95–18.5
	20.95–21.5
	24.45–25.1
	27.95–30.0

Modes: SSB (A6J) / CW (A1) / FM (F3) / RTTY (F1) / AM (A3)
Frequency Control: CPU-based 10-Hz step digital PLL synthesizer
Frequency Stability: (±) 100 Hz (14–140°F)
Antenna Impedance: 50 Ohms
Power Requirements: 100–120 Vac

Dimensions:	424 mm x 150 mm x 390 mm w/o projections (16.7 in x 5.9 in x 15.4 in)
Weight:	17.5 kg 38.6 lbs

Receiver

Conversion System:	SSB, CW, RTTY, AM quadruple conversion FM triple conversion	
I-f Frequencies:	1st i-f all modes	70.4515 MHz
	2nd i-f SSB	9.0115
	CW/RTTY	4.0106
	FM/AM	9.0100
	3rd i-f all modes	455 kHz
	4th i-f SSB	9.0115
	CW/RTTY	9.0106
	AM	9.0100

Sensitivity (preamp on):	SSB/CW/RTTY
for 10-dB S/N	.1–.5 MHz less than .5 microvolt
.5–1.6	1.0
1.6–30.0	.15
AM (narrow filter)	
.1-.5 MHz less than 3 microvolt	
.5–1.6	6
1.6–30.0	1
FM	
28–30 MHz less than .3 microvolt at 12 dB SINAD (Signal to Noise and Distortion)	

Squelch Sensitivity: less than .3 micro volt

Selectivity:	SSB (filter on)	2.4 kHz/-6 dB
		3.8 -60
	CW/RTTY (filter on)	500 Hz/-6 dB
		1 kHz -60
	AM	6 kHz/-6 dB
		18 kHz -50
	FM	15 kHz/-6 dB
		30 kHz/-50

Audio Output: greater than 2.6 W at 10% distortion into an 8-Ohm load

Notch Filter Attenuation: greater than 45 dB
RIT Range: (±) 9.9 kHz

Transmitter

Output Power:	SSB max 100 W PEP	
	AM	40
	CW	100
	RTTY	100
	FM	100

FM Deviation: (±) 5 kHz
RTTY Shift: 170 and 850 Hz
Spurious Emissions: less then -60 dB
Carrier Suppression: greater than 40 dB
Unwanted Sideband Suppression: greater than 55 dB
Microphone Impedance: 600 Ohms

Antenna Tuner

Output Matching Range: 16.7–150 Ohm unbalanced feedline
Minimum Input Power: 8 W
Band Switching Time: 3 seconds or less
Auto Tuning Time: 3 seconds or less
Auto Tuning Accuracy: vswr 1.2:1 or less
Insertion Loss: 0.5 dB or less (after tuning)

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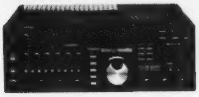

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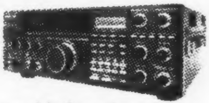

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by Dr. Ralph E. Taggart WB8DQT

Facsimile, or simply Fax, is the oldest of our video technologies. It has been used since the turn of the century to transmit copies of documents or photographs—first over telegraph and telephone lines and later via radio. All approaches to Fax are geared to send complex images over voice-grade circuits. They accomplish this by sending the information relatively slowly. In principle, they operate like slow-scan TV, which actually was called cathode ray facsimile when initially introduced by McDonald back in 1957. But instead of sending a 128-line image in 8 seconds, pictures with many hundreds to several thousand lines of resolution are transmitted over a period of from 3 to 15 minutes!

> *"Fax is the oldest of our video technologies."*

Today, Fax systems range from systems designed to transmit office documents over phone lines to HF links carrying weather charts and press photos, or the transmission of satellite cloud cover images at VHF and microwave frequencies. In recent years, an increasing amount of Fax traffic is also carried on subcarriers on the satellite TV transponders of the many DOMSAT spacecraft scattered along the Clark Geostationary Satellite Belt. This short introduction will concentrate on Fax systems for HF and VHF/microwave links. Various Fax systems differ in a number of primary features including the image format, video modulation, the basic recorder design, and the nature of the media used.

Photo A. The Alden Weatherchart Fax recorder.

Image Format

The image format used by a specific system can be expressed as two components—the line rate and the *index of cooperation* (IOC). The line rate is simply the number of lines transmitted every minute. Standard line rates are 60, 90, 120, 180, and 240 LPM. Sixty LPM is rarely used these days because of the longer transmission times. Much press wirephoto activity occurs at 90 and 180 LPM and some countries transmit weather charts at this speed. An almost universal standard for weather chart (map) transmission is 120 LPM. It is used in some satellite links like U.S. TIROS/NOAA and Soviet Meteor polar orbit spacecraft. Standard 240 LPM is used primarily for satellite image transmission.

The scanning rate of a format corresponds to horizontal scanning in a TV system. In addition to the equivalent of the horizontal scanning rate, the equivalent of vertical scanning must also be matched in printing out an image if the copy is to look like the original. Compatibility in vertical scanning is determined by the index of cooperation which is an index that defines the relationship between the width of the copy in inches (W) and the number of lines per inch (LPI) printed by a particular system:

IOC = (LPI x W)/3.1416

Regardless of the width of copy printed by a particular system, if the line rate and IOC match, the copy at the receiving end will have the same proportions as the original at the transmitter site. The IOC match does not have to be perfect for acceptable copy but it should be close. Most weather charts are transmitted at 120 LPM with an IOC of 576. If the transmitter is using an IOC of 576 and the receiving recorder is using 288, for example, the received copy will be stretched to twice the proper length. If the transmitting IOC is smaller than the IOC of the receiving system, squashed copy—too short in vertical dimensions—will result.

The line rate and lines per inch of a particular recorder are usually set by synchronous motors, driven from a crystal frequency standard, in tandem with belts, gears or other mechanical linkages. It is possible to make a Fax recorder with multiple line and IOC rates but such machines are mechanically complex and usually quite costly. Most Fax recorders are built for a single line rate and IOC to fit the class of service they are designed for.

Video Modulation

There are two main systems for transmitting the video data, both of which depend on modulation of an audio subcarrier. AM subcarrier modulation was the first to be used and it is still found in VHF and microwave satellite image transmissions. In these systems, the amplitude of a 240-Hz subcarrier is modulated so that minimum amplitude corresponds to black while maximum amplitude corresponds to white. Rf satellite transmissions are made using FM so signal fading is not a problem. This is definitely not the case with HF transmissions,and HF Fax uses an FM subcarrier modulation system. In this system the subcarrier is varied from 1500 Hz for black to 2300 Hz for white.

HF Fax systems thus can use an audio limiter in such FM or FSK modes, and signal fades pose no problems as long as a decent signal-to-noise (or QRM) ratio is maintained. Switchable video systems are easier to implement than multiple line rates and IOC standards. Thus it is more common to find recorders that will handle both video modes, although machines designed for a single service will usually only have one or the other.

Although there are some hybrid approaches, most Fax recorders can be designated as either drum type or continuous feed systems. The drum system is quite simple in that the recording paper is wrapped around a drum (manually or automatically) and the drum is rotated at the line rate. A light gun or stylus is then moved along the length of the drum to provide the vertical scanning. In the continuous feed system, the recording paper feeds from a roll. The printing stylus, either a continuous helix or a belt-driven system, scans across the paper while rollers feed the paper at the proper rate for the design IOC with the final image feeding out of the front of

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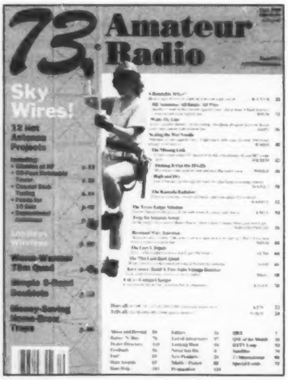
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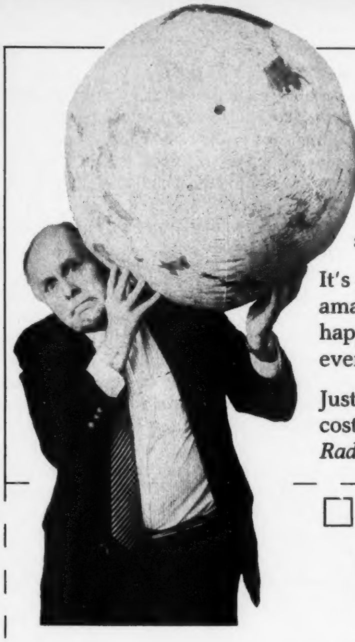

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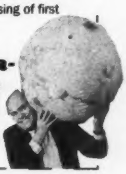

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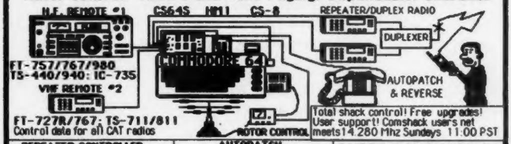

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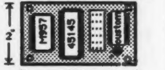

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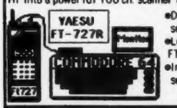

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the machine. Generally, drum systems tend to be simpler, but continuous feed systems have the advantage of printing many pictures without the need to constantly load new paper.

Recording Media

The paper on which the image is printed generally can be classified into three broad categories—photographic materials, electrostatic papers, and electrolytic papers. Photographic media include photographic film, photographic papers, or various kinds of non-conventional light-sensitive (dry silver) papers. These are exposed with a modulated light source and are capable of the very best halftone image reproduction. In return for the quality, there are a number of disadvantages. The materials must be protected from external light sources during storage, loading, exposure, and processing. All require either conventional wet photographic processing (internal or external) or, in the case of the dry silver media, the paper is run through a set of heated rollers for processing.

Electrostatic papers usually use a wire printing stylus operating at a high voltage (up to 250 V for some papers). The paper has a black base layer and a white surface coating. The printing voltage burns away the white surface layer to varying degrees, ranging from white to black. Electrostatic papers produce a nice grayscale and can be handled in normal room light like any other paper product. The images are absolutely permanent and will not fade or discolor. The two major disadvantages of electrostatic papers are that they do not easily lend themselves to continuous-feed systems, particularly homebrew systems, and they do produce some smoke and odor during the printing process.

Electrolytic papers incorporate chemical compounds which alter when subjected to a flow of current, producing a trace that is proportional in intensity to the printing current. They are used primarily in continuous-feed systems because the paper must be moist in order for the electrolytic printing action to occur. The compartment that holds the paper roll is designed to inhibit drying of the paper. Electrolytic papers tend to be a little fussier in terms of getting a good grayscale. Midrange grays are distinctly sepia while blacks tend to have a purplish cast with most types of paper.

Image permanence is highly dependent on the type of paper used. Earlier formulations tend to fade or discolor but the newer grades of paper are quite a bit more stable. Electrolytic papers are almost universally used in weather chart recorders and are also found in many wirephoto systems.

Sources of Fax Recorders

There are not many options for obtaining a Fax recorder. New machines, particularly those that will handle satellite video formats, are quite expensive. That leaves the options of home construction and surplus! Surplus units tend to be bulky—they have been traded in or sold as part of upgrading to more modern equipment—and supplies of parts and paper can become critical, depending upon the original manufacturer and his policy of supporting older equipment. You *can* build your own and the *WSH*, for example, features a very functional drum-type system using electrostatic paper that gives very good results. Building your own Fax recorder does require a unique blend of circuit construction and mechanical fabrication, and this mix does scare off some potential Fax enthusiasts.

> ***"One of the finest kits I have ever had the pleasure of working with!"***

The Alden *Weatherchart*™ Recorder

Alden Electronics of Westborough, Massachusetts, has introduced an exciting new option in the Fax game with the introduction of a kit version of their compact *Weatherchart* Fax recorder. Priced at $995 (plus $5.00 shipping and handling), the kit is more expensive than the homebrew alternative but does offer a commercial grade recorder at a price less than what most folks are spending for dot matrix printers and considerably below the going rate for other commercial recorders.

This magazine, *73*, obtained one of the kits to add to the ham station. The editor called to ask whether I might be interested in putting the unit together and preparing a review. I had seen the unit at several Dayton Hamventions, but I knew that it was basically an HF machine and I had not paid much attention due to my satellite interests. However, I had come up with a rather neat idea in the interim (more on that later) and a look at the Alden system fit in quite nicely. Now, for the focus of this piece—which has taken some working up to!

The unit is completely solid state and is quite compact (9.2 cm H x 43.3 cm W x 26.7 cm D) and operates off the 110-120 V ac (50/60 Hz) mains at a modest 10 W on standby and 30 W while printing. The recorder is designed for 120 LPM with an IOC of 576 (196 lines/inch). The unit accepts subcarrier FM modulation (1500 Hz black to 2300 Hz white). Auto-start (300 Hz start tone), auto-stop (450 Hz tone) and automatic phasing are provided. The recorder has black (1500 Hz) and white (2300 Hz) LED indicators for tuning.

The system is a continuous-feed design, accommodating a 35- foot (10.7 m) roll of 11 inch (27.9 cm) wide paper in a unique paper cassette that I will talk about shortly. Each cassette is good for about 30 charts (± depending on the type of chart). Alfax electrolytic paper is used, and the finished charts feed out of the front of the machine with no need for additional processing. The images are said to be permanent.

The Kit

So what do you get for slightly less than a kilobuck? The answer: one of the finest kits I have ever had the pleasure of working with! The unit is built like a tank to the best commercial standards, it's good value for the money, *and* it's made here at home!

The kit arrives in a single, well-engineered carton that makes shipping damage highly unlikely. The box is packed in two layers. The upper contains the manuals, main chassis components, the main circuit board, and two cassettes of paper. The bottom layer features 13 numbered compartments, each with a bagged set of components and each individually foam-wrapped.

The individual or team at Alden that engineered the kit package deserves the highest praise. Alden has been one of the outstanding companies in the Fax realm for years, and it shows in virtually every aspect of the kit. Documentation is voluminous and complete to the last detail. The main construction manual is 36 pages in a heavy-duty looseleaf binder. In addition, you get the 34-page operating manual that normally is supplied with the factory-assembled version plus six different manuals that provide frequency lists and schedules for Fax transmissions for every part of the world. When you finish the unit you will have no lack of information on how to put it to good use.

Assembly

Putting the kit together is a breeze. The two circuit boards are completely wired and tested and require no alignment! The kit itself is complete to the last component, including a supply of solder and heat-shrink tubing. All wires are cut to length, stripped, and tinned. Most of the wiring goes to two Molex® connectors, and those wires have the proper pin connector already installed!

About 75% of the construction consists of mechanical assembly. Most wiring is concentrated at the end, immediately before and after the installation of the circuit boards. One of the things that makes things go so smoothly is the good coordination between the documentation and the parts packages. Each time you turn a page of the manual you are dealing with a new parts package and everything is covered on the spread of the two pages on the looseleaf assembly manual. Each package contains a relatively small number of parts, a factor that makes it easy to keep track of the different components. Ample pictorials, both of parts and assembly steps are provided, so there is no problem knowing what you are to do. Each step is carefully explained, and you have a checkoff box for each step to mark your progress.

The control panel with all of its switches and indicators is wired as a single assembly. At the very end it will be interfaced to the main board via a header cable and to the mainframe wiring via a Molex connector. The rest of the mainframe wiring comes into another Molex connector which plugs into the main circuit board. A small circuit board for the marking power supply and amplifier connects to the main board via a cable that is already in place on the smaller board. In short, there is very little opportunity for error.

Construction took about 6 hours spread over two evenings—including a number of leisurely coffee breaks. Had I been building it for myself, I probably would have finished in

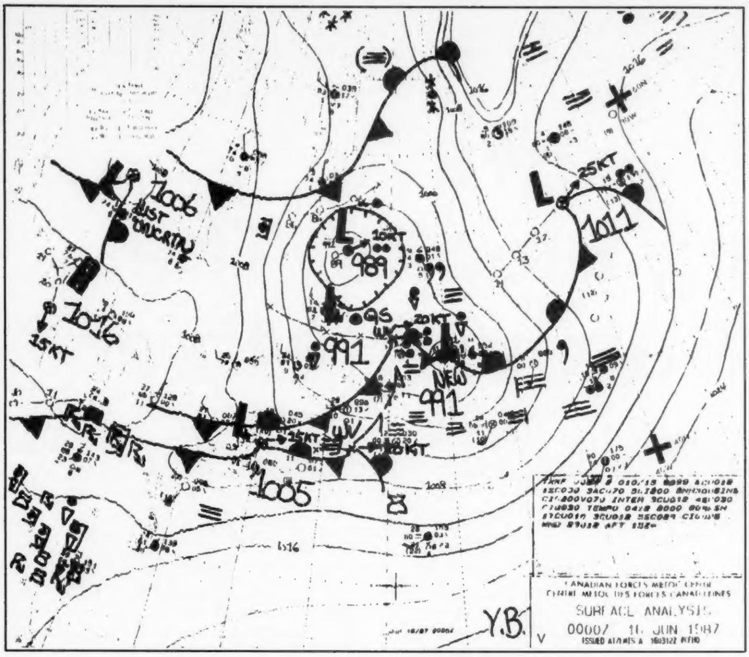

Fig. 1. Sample weather chart.

one long evening! The work, oriented around the individual parts packages and exemplary documentation, proceeds so smoothly that the project is done about the time you begin to wonder where the hard parts are going to be!

Checkout and Operation

Final checkout is quite simple since the boards themselves are pretested and aligned. Most of the checks involve the use of an ohmmeter to be sure that you haven't made a wiring error that will generate smoke! Once that is assured, do a few basic operating checks to assure yourself that the stylus belt is moving in the right direction and that the paper-feed rollers are operating—and you are ready to print a picture!

The Alfax™ paper is contained in a semi-flexible plastic cassette that is clear so you can see how much paper remains. The grounded printing blade is a part of each paper cassette so you need not worry about this part wearing. Alden suggests replacing the stylus belt with every 6 cassettes of paper. If you order their paper in boxes of 6 cassettes (Stock Number CB1135J-K1, $39.95 plus $3.00 shipping and handling), you also get a stylus belt assembly with each box. A box of two cassettes (without a stylus belt) costs $9.40 and the stylus belt goes for $15.00—so you do save with a six-pack. I should note that the kit includes an extra stylus belt. In the unlikely event that you damage the first one, you do have a spare.

Paper loading consists of lifting the pressure roller assembly at the front of the machine, followed by insertion of the paper cassette. You should pull a little paper from the cassette prior to installation and verify that it feeds out smoothly. Both cassettes packaged with the kit were very stiff in terms of paper feed and the feed assembly could not pull the paper out properly. In both cases, I had to manually pull the paper out until the paper would feed smoothly. I had a chance to use two cassettes from a fresh package of six and neither of these had the same problem. I suspect the difficulty occurs with the paper packed with the kit because it may be sitting unused for an extended period.

Most Fax transmissions are made on upper sideband. Between charts, the stations will be transmitting a white (2300 Hz) tone. In such a case you should tune the receiver to the proper frequency and adjust the tuning so the white LED comes on. Assuming the recorder is on, the system will begin printing with the receipt of a start tone and will stop automatically at the end of the chart when the stop tone is transmitted. During the chart transmission, the black and white LEDs will alternately flash with the pattern depending on the type of picture being transmitted. The operating manual clearly shows the various possibilities—tuning in on a Fax transmission mid-chart is quite easy with a little practice. In such a case you will have to use the START button on the front panel to initiate printing and use the FRAME switch to properly phase the picture.

Results

Although I have two ham-band-only transceivers, my general coverage options are limited to a Panasonic rf-4800 receiver covering 3–30 MHz in a slew of bands. This receiver does have digital readout but it is *not* synthesized and it drifts like mad! The CW/SSB option is supported by a variable bfo, an arrangement that will be fondly (?) remembered by many old-timers. The bfo also drifts! Given this superb receiving arrangement, I really didn't think I would be able to copy any weather charts without borrowing a receiver—but here I was, late in the evening, with a completed Fax recorder and the equivalent of a digital-readout crystal set. What the heck!

Imagine my surprise when the Alden machine actually did deliver some quite acceptable charts! Most of the time I had to sit there tracking the bfo to try and maintain the same flashing pattern on the LED tuning indicator. And imagine my surprise to actually see the recorder auto-start and auto-stop and actually print a chart in between! Numerous charts were copied from NAM, the U.S. Navy Fleet Broadcast station out of Norfolk on 3357, 8080, and 10865 kHz. Charts from CFH in Halifax were also copied on 4271 and 6330 kHz. If I were to get seriously involved in HF chart activity, I would probably build a receiving converter for use with one of my HF transceivers to get the required stability for long-term unattended operation.

In operation, the recorder is fairly tolerant of incorrect tuning. In part, this is due to the sharpness of the video transfer function—the system tends to want to print either black or white and the transition between the two is fairly abrupt. This is another way of saying that the unit does not print a good continuous grayscale in normal operation. I don't really mean this as a criticism since Alden designed the unit for weather charts and they don't even imply that it should be used for halftone reproduction. The video characteristics are ideal for preventing unwanted shading of charts due to mistuning, and that is how they expect the system to be used.

One problem that did arise during early printing sessions was a stubborn tendency to tear the moist recording paper along the right margin. At this point pressure is applied to the cassette blade where the edge of the paper passes over a small metal tab known as the stylus ramp. This metal strip is designed to deflect and stabilize the stylus as it comes around just prior to its track across the paper. Endless tinkering established that the metal stylus ramp was basically too thick and was causing the blade to press down too hard on the paper at the point of contact, resulting in a tendency for the paper to tear. In exasperation I finally removed the metal ramp strip and installed a thin plastic strip, trimmed to the same size as the original, which I cut from a plastic component bubble-pack. I taped the plastic strip in place from the rear using a bit of transparent tape and the strip worked perfectly—no more tears!

I was quite surprised a few days later, when unpacking a six-pack of cassettes, to find a little envelope packed with the stylus belt marked "Replacement Stylus Ramp." It was a strip of thin plastic! Apparently some of the kits were furnished with a metal ramp while later versions use the plastic. The replacement was a dead ringer for the one I had made and should cause no tearing problems. If your kit has the metal ramp (it's one of the first parts

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San Diego Microwave Group
6345 Badger Lake Drive
San Diego CA 92119

Microwave Building Blocks: The Doubly-Balanced Mixer

WB6IGP adds another piece to his puzzle.

This article describes a high-performance doubly-balanced microwave mixer that you can construct. This can be used in a downconverter giving good isolation between all ports—unlike the relatively poor performance of the singly-balanced mixers. The operating frequency range of this mixer can be any frequency up from 500 MHz, depending on the size and scaling of the device.

I wanted to build a system for single sideband on 1296 MHz but didn't want the unit to be purchased or locked into a design in which the components could not be used in another project. I wanted the components to be universally adaptable, and that required a building-block concept with all units connected with coax. In this way, as I worked toward my goal, each unit of the project would be constructed and tested by itself and could be used in another project if I desired.

The use of doubly-balanced mixers is not new and there are many available. The most common of them are the little eight-pin packs available from several manufacturers such as Anzac (MD-108), Mini Circuit Lab's (SRA-1), and Relcom (M6F). I have been able to obtain and use all of these units and find them excellent in their application. The devices exhibit very good isolation between all ports, keep spurious responses to a minimum, and, having a slightly higher conversion loss than singly-balanced mixers, require an amplifier following the mixer. This is a very small price to pay for the performance they give. See Fig. 1 for details.

One deficiency is the lack of units that give the same performance in the higher frequency range above 500 MHz. The lack of availability of this type of reasonably-priced mixer was the prime reason for starting this project. First, I built several types of mixers (singly balanced) to be able to gain some insight into what was needed. The first design that I tried was a Rat Race mixer, which looks like a stop sign. I tried everything to make that design work but had little luck. I then tried the Rat Race mixer that resembles a rectangle that is similar to the stop-sign mixer tried previously. This rectangular Rat Race mixer worked as advertised. This was the mixer that was used in the 1296-MHz stripline transceiver in the 1985 *Handbook*. See Fig. 2.

No project is a loss, and the stop-sign Rat Race mixer taught me several things about striplines, the method of running them, and the discontinuities you can have if you run the lines at a sharp angle. I found out that by mitering (slicing off) the sharp edge at the right angle junction, you improve the impedance transformation around the bend. If you leave the junction with a sharp edge, you will see a sharp spike in the standing

Photo A. Mixer front view showing diode placement and common ground strap.

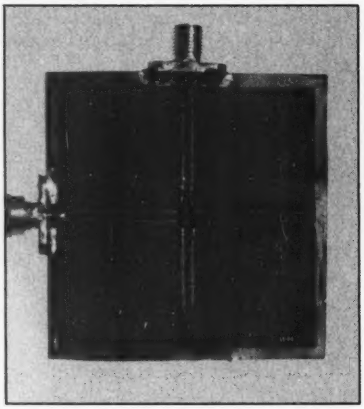

Photo B. Mixer rear view showing jumpers with insulation required for tuned lines.

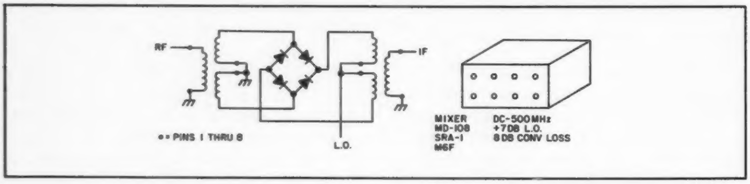

Fig. 1. Common doubly-balanced mixer design for Dc–500 MHz.

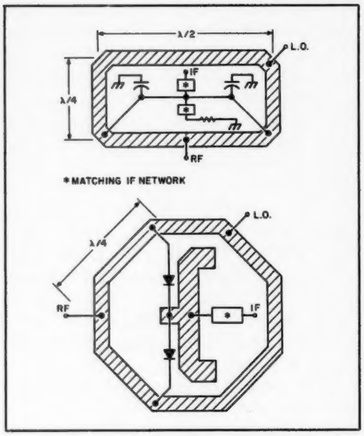

Fig. 2. Rat Race mixers 1.3 GHz (not to scale).

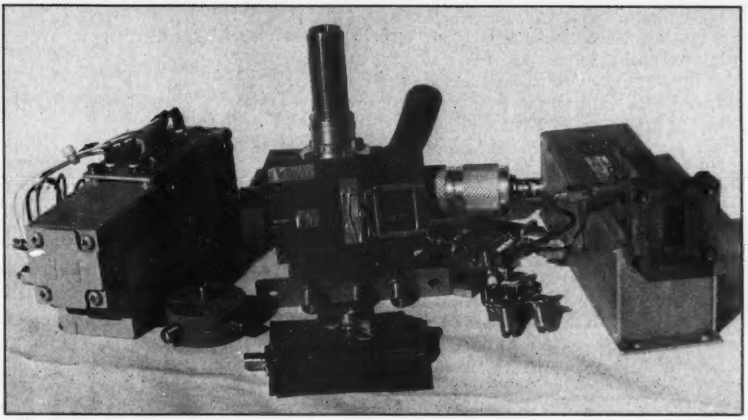

Photo C. A collection of the "building blocks."

wave at the junction (a rather large discontinuity). There is a ratio to determine how much you should slice off, but, not being a purist, I elected to remove about 25% of the junction and it seems to work out OK. An alternative method is to use rounded bends with a radius of three to four times the stripline width. See Fig. 3 for details on the junction mitering.

PC Board Materials

There is a field full of printed circuit board materials to choose from, including paper, epoxy, fiberglass, Teflon™, and ceramics. Each has a different dissipation factor and dielectric constant depending on the material used as the host for the copper substrate. Paper is not a good choice, since it acts as a wick which absorbs moisture from the surroundings, which eventually ruins the dielectric. Epoxy and fiberglass are good board materials, and the G-10 variety glass epoxy can be used up to the 1–2-GHz microwave bands with reasonable results. Almost all printed circuit boards used today use a good quality glass-epoxy. It has a dielectric constant of about 5.5.

The next upgrade in printed circuit board material is Teflon or Duroid. Both types of board have a dielectric constant of about 2.2 to 2.5 and are excellent selections for use at microwave frequencies. They offer excellent dimensional stability in high-temperature and high-humidity environments without affecting the board. They are also very resistant to solvents and chemicals.

By the way, if a board states it has 1/2 oz. of copper, it means that the PC board has a .0007-inch-thick layer of copper on one side (1 oz. of copper equals approximately .0015-inch-thick copper; 2 oz. equals approximately .0020-inch-thick copper). Also, the copper is not applied to the Teflon with adhesives or glue, but is pressed on with heat and considerable force; it does not come off once pressed!

With all this now in firm grasp, I proceeded to construct the 3-dB hybrid mixer. This unit looks somewhat like a figure "H" lying on its side with a large square hole in its center. This mixer was the first successful hybrid type that I constructed (see Fig. 4).

This mixer consists of three sections: the input coupler, the diode array, and the i-f matching network. I have used this mixer in a lot of designs, the most recent being the 1296-MHz ATV receiver (October, 1985, *73* Magazine). I also used the same mixer design in a receiver for 2300 MHz and 4200 MHz. I never had a failure with this design and am very impressed with it.

To sum up the performance of the singly-balanced mixer, it is easy to construct and a proven performer. The design uses few components and requires a lower-level local-oscillator power injection. However, the one drawback is that the isolation between ports is poor. Local-oscillator energy can be reflected into the rf port and all sorts of things can happen, such as spurious responses.

Although it created problems of its own, the next mixer I tried proved to be the best overall. The design was first noted in a piece of surplus scrap that was torn apart to see what was going on inside. It was intended for 8–10 GHz, but the principle of its operation remains the same. The unit used two crossed lines looking like a tuning fork with another pair of crossed lines identical to the first. They were constructed on very thin Teflon PC board about .003 inches thick (the thickness of a piece of paper). The orientation of the two crossed lines was at 90 degrees with a 50-Ohm stripline tied to the input of each of the tuning-fork-like striplines. There was a third thin PC board that had four quarter-wave striplines that looked like a four-leaf clover, and at the junction of the quarter-wave stubs were four diodes alternating (anode, cathode, anode, cathode) connected to the stubs.

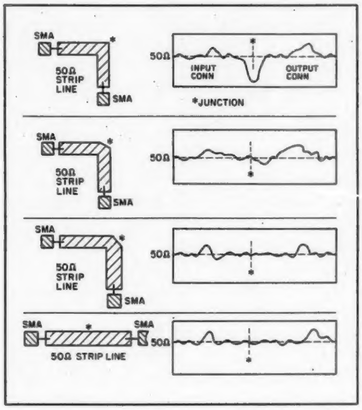

Fig. 3. Stripline junction mitering.

The common point of the four diodes was tied to a stripline for coupling into the device, and Eureka!—a doubly-balanced mixer. One friend's suggestion led to the final design of this mixer: Place it on one single piece of PC board with both striplines (the tuning-fork-looking guys) on one side and the four stubs on the opposite side of the board.

This simplifies the design over the original three-PC-board construction, and makes it easier to reproduce. I located a few pieces of .010" thick Teflon fiberglass material and laid out the mixer design. Even though I use the photographic process to reduce my hand-drawn artwork to proper size, other methods are available. The dimensions for the striplines are: on the diode side, all lines are .100" wide. For the other side (the tuning forks), the line width is .010"–.015" inch; at the point of connection to the coax connector, line width is .025"–.030".

If you use larger values in the etching, you will most likely have some undercutting producing something near the correct dimensions. Not being a purist, I find that you can violate lots of rules, but by not straying off too far, you still can have very good results. I do not have all the instrumentation at my disposal to find out all of my faults; I let performance prove out operation.

One method to make your own PC board is to place masking tape cut to the desired width on the PC board where you want the copper to remain. There is also PC artwork tape that comes in pre-cut widths. This is recommended for lines that are .010" thick. I use the Bishop Graphics PC tape, and it has worked well on these fine lines in early prototypes.

Lay out the tape and press it onto the copper surface firmly, being careful to cover all ar-

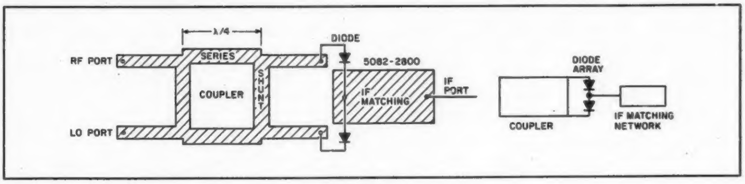

Fig. 4. 3-dB hybrid mixer.

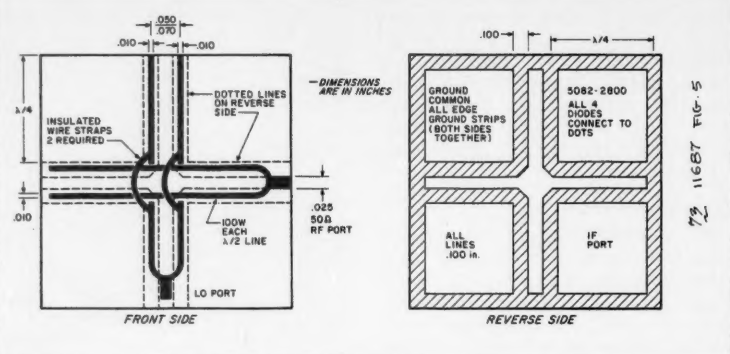
.050
.070
.010
.010
λ/4
INSULATED WIRE STRAPS 2 REQUIRED
DOTTED LINES ON REVERSE SIDE
—DIMENSIONS ARE IN INCHES
.010
100W EACH λ/2 LINE
.025
50Ω RF PORT
LO PORT
FRONT SIDE
.100
λ/4
GROUND COMMON ALL EDGE GROUND STRIPS (BOTH SIDES TOGETHER)
5082-2800
ALL 4 DIODES CONNECT TO DOTS
ALL LINES .100 in.
IF PORT
REVERSE SIDE
73 11687 FIG. 5

Fig. 5. Doubly-balanced mixer (not to scale).

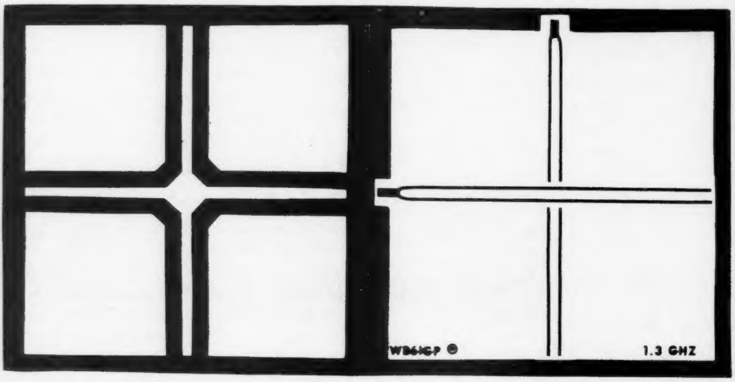

Fig. 6. Artwork, 1.3 GHz mixer. 1:1 scale.

eas you want to protect from the etch. Where you must overlap tape, press lightly with your fingernail on the overlap to reduce any air gap that etch may flow into and undercut the board. Check your tape carefully, as you want none of the tape to fall off in the etch. If it is pressed on firmly but not hard, it will hold. Also, don't press too hard with your fingernail, as this could deform the soft Teflon. I suggest that you use new ferric chloride so that the time in the etch will be at a minimum.

A variation of the above would be to cover the two sides of the board with a short piece of two-inch-wide tape. Lay out the pattern with a pencil and cut the lines with an X-acto™ knife, removing the pieces of tape where you want the copper to be etched away. Do not use hard pressure, or the knife will deform the PC board. See Fig. 5 for details, and Fig. 6 for the artwork for a 1.3-GHz mixer design.

I used several varieties of Hewlett Packard Schottky diodes in the mixers. The 5082-2800 (1N5711) family is available at Radio Shack. The 5082-2835 is a better choice, but could be a problem to find. Some of the mail-order houses have them in stock.

Each diode is mounted to the bottom of the stripline quarter-wave stubs at the junction. The diodes are mounted in an alternating fashion: anode side down, anode side up, anode side down, and finally, anode side up. The opposite sides of the four diodes are tied common, and together they form the i-f output port. It does not matter where you start placing diodes if they are uniform, matched, and alternate around the quarter-wave stubs. I mounted a wide strip of copper from the common foil (both sides' foil tied common) ground edge strip up over the i-f port coaxial connector and on to the opposite side ground foil, to provide a good ground return for the i-f port. Final assembly can be into a small metal box with the i-f port connector fixing the assembly in place. Then the other two connectors can be mounted on sides adjacent to each other at the flange end of the stub lines. Solder the flanges to the ground foil and the center pins to the terminus of the stripline couplers (the tuning-fork-looking guys).

Checkout/Operation

If the diodes are good and there are no solder bridges, the mixer should work without adjustment. Bandwidth for usable performance, according to the textbooks, is plus or minus 500 MHz, or 800 to 1,800 MHz. I tried the mixer out on 450 MHz because I have two calibrated signal generators for this band. I supplied 600 MHz at +8-dB injection into the LO port and connected the i-f port to my two-meter radio. Connecting my test signal generator to the rf port, I set it for 450-MHz input and found that I could reduce the power to the .2-uV level for very near full quieting on the two-meter i-f. Attaching a 450-MHz antenna, I was able to copy many repeaters and even tune up into the commercial band. It performed well.

I tried the mixer out with my trusty old klystron-powered 1.3-GHz signal generator and the results were much the same. Stability was poor, but that was due to the fact that the injection oscillator was free-running and drifting. However, that was the only source at the time that would drive the mixer with the required +8-dB LO injection. The sensitivity was 1 uV, but I believe part of that was in the loss of the coaxial cable used to connect to the input of the mixer. So far this is the most sensitive test that I have performed at this frequency.

I hope that those who undertake this project will find that this mixer is quite a performer and will serve many different uses. I plan to use the mixer in SSB converters for 1296 and 2300 MHz. There have been many articles on rf amplifiers. The device following the mixers will be one of the broadband amplifier modules. I have used the MC-5121 and the MWA-110/120-type monolithic amplifiers and they have worked for me in the past. Just remember to keep the i-f port terminated in 50 Ohms and you will not have any trouble with this or any other mixer.

One point of operation that I did not mention and have not tried is using the mixer in an upconversion mode, using the i-f port as an input, keeping the LO port for injection, and now using the rf port as the output source for driving an amplifier chain to drive a final stage.

This mixer is something UHF experimenters can play with and expand upon. As always, I would be happy to answer any questions concerning this project and other related items. Please enclose an SASE for a prompt reply.

If you are unable to obtain the double-sided Teflon PCB stock, I can provide the .010″-thick double-sided board for $5.50 U.S. postage-paid, or 5 pieces for $20 postage paid, in the U.S. It is available in other sizes up to .062 inches thick. I can also help out with the diodes if you can't obtain them locally; Radio Shack used to have them. ■

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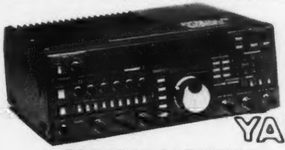

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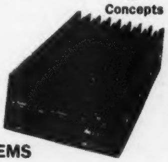

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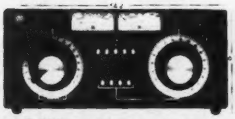

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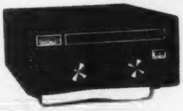

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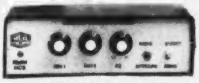

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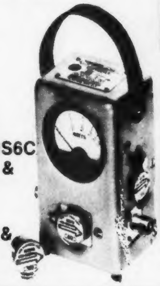

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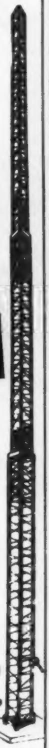

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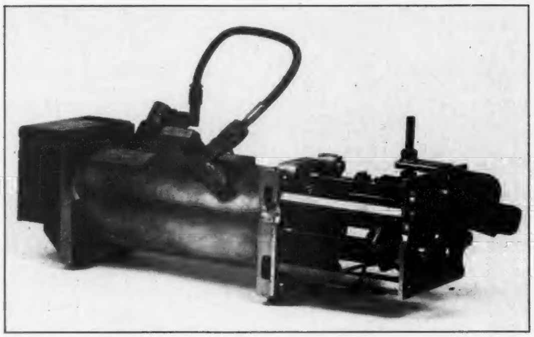

Photo A. An unmodified Adler UHF cavity. The input is visible to the front of the cavity wall and the output is to the rear.

The theme of this month's *73* Magazine deals with cheap and easy ways to get on the frequencies above 900 MHz. After a lot of head scratching, I found a likely subject sitting on the shelf above my operating table, and will now enthrall readers with tales of a cheap amplifier for the 23-centimeter band that requires minimal modification, a simple power supply, and a few hours of your time. The catch? The cavities are not the easiest parts to find . . . but read on.

Some time ago, the Adler Electronics Corporation of New Rochelle NY manufactured a device consisting of three tuned cavities—two operating as power amplifiers, and one as a mixer. The eventual operating frequency was above 1300 MHz with power levels in the 100-watt range. The actual cavities used employed a 2C39A tube in a compact, grounded-grid design, using a plunger assembly for tuning. These cavities went under the identification number #6553-603B9, and a representative unit is presented for your viewing pleasure in Photo A.

The cavity is to the rear with the short Teflon coax extending from the housing. Controls for plate tuning and loading are at the front and employ reduction gearing as well as a chain drive to allow somewhat smooth tuning. No input circuit was employed for the cathode—indeed, the typical swr of one such cavity is pretty awful, on the order of 4:1 or worse! But, tubes being what they are, the impedance mismatch didn't matter much. Nominally, the amplifier functions at about a 10-dB power level, with a maximum rating of about 100 Watts output.

Steve Katz WB2WIK has modified these cavities in the past, and recently located another mixer/amplifier assembly that he had stashed away some years earlier. I suggested that another conversion might be in order, and away we went! The most important part of this conversion is to lengthen the cavity by increasing the plunger's tunable range. The simplest way to do that is to install shims at the points where the plunger assembly attaches to the cavity—allowing the plunger to pull out a bit further and make the resonance point of the cavity drop in frequency.

Photo B shows where the shims are inserted. A pencil points to one of the four holes where a standard 8/32 nut has been slipped over the attaching screw. This is repeated at each of the other three corners. Use care when removing the screws! You don't need to pull the plunger assembly out—just the screws, and only far enough to insert the shims. (Told you this was easy—so far!)

Photo B. The pencil shows where to insert the 8/32 nut shims to extend the length of the cavity. A total of four shims is used.

File and Fit

One problem which will become evident right away: You won't be able to re-attach the TNC connector to the cathode input line. The solution is simple: Get a strong flat file and determine the final position of the connector when installed. File the side closest to the cavity as flat as possible without filing through the wall of the barrel. Reinstall the connector, then install the shims. It'll make for a snug fit! The supplied connectors are made from silver and file quite easily.

What you've now done is to allow a tuning range down to about 1295 MHz (whereas the original tuning cut off at about 1300 MHz) and will be able to see a definite dip at resonance. After you've refastened the plunger assembly, the mechanical work is done and a suitable power supply must be concocted. There are only three voltages required—6.0 Vac for the filaments, 1000 Vdc for the plate, and an adjustable source of 8–20 volts for the cathode. This latter source is the bias circuit and sets the plate current, determining the class of operation.

When you obtain the cavity, you'll notice three connections: two wires from the front side of the chassis, and a connection near the tube anode to the chassis rear. The first connection is for the cathode/filament of the tube, and the rear connection for high voltage. The filament chokes are already in the cavity assembly as is the plate choke, so connections to the high voltage and bias supplies are a snap.

Figure 1 shows a suitable supply. Zener diodes can be used in a string to set the cutoff bias. This way, the addition of a phono jack to pull to ground part of the string will set the correct operating voltage. Photo C shows a completed amplifier with front panel plate current meter, power switch, and indicator lamp. The filter capacitors in the HV line aren't particularly pretty, but are surplus GE Pyranol types, each rated at 4.0 uF at 2000 Vdc. They only cost $2.00 apiece from a surplus outlet, and the HV transformer set me back about $7.00. It's rated at about 800 volts CT and 400 milliamperes—plenty hefty for the job.

NOTE: Many surplus oil-filled capacitors were manufactured with an oil containing Polychlorinted Biphenyls (PCBs), a potentially lethal compound and proven carcinogen! If you have any doubts about oil-filled capacitors of indeterminate origin, PLAY IT SAFE and select computer grade units. You can gang these in series to obtain the required capacitance/voltage rating.

The full-wave bridge should use diodes with a hefty rating. They should be able to handle 1.5 kV at about 1 amp, but in this model, two 1N4145BD devices were employed in each leg to achieve that purpose. Photo D shows the underside of the completed amplifier with the HV rectifiers to the upper left, HV transformer terminals to the lower left, and the bias/filament transformer to the upper right.

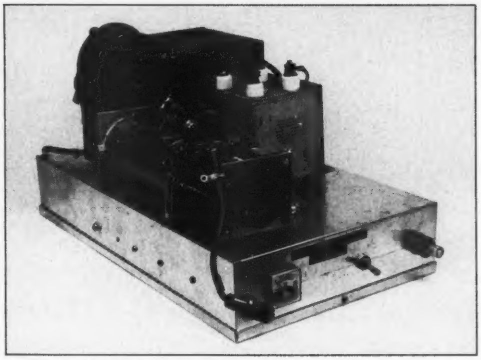

Photo C. View of the completed amplifier and power supply chassis. The space to the right of the cavity is used for a Bird 43 wattmeter and coaxial relay.

The Filament Connection

A string of 5 conventional silicon diodes (1N4004 types) are used to raise the cathode above ground by a total of 2 volts. These are connected in series with the center tap winding of the filament transformer. Two 8.2-volt 1-watt zener diodes are then connected from this point to ground to establish the standby bias of +18-20 volts. By grounding the junction between the two zeners, the bias drops to about +8-10 volts which should result in about 50-60 mA of plate current on standby.

The high voltage bleeder resistor is located on the upper edge of the chassis. The value is not critical; this particular resistor was a 20-k 40-watt unit. Any junkbox unit between 20 k and 100 k will do—the higher values will just result in smaller bleeder current. Incidentally, the original cavities come without any blower! This is very important, so root through your junkbox or the next flea market to find about a 3-4 inch diameter squirrel cage with about a 1" exhaust port.

Use a good strong epoxy to fasten this port on the top rear of the cavity. There's about a 1-inch square hole here allowing access to the fins of the tube, and a small squirrel cage blower will keep the tube nice and cool. I tried 5-minute epoxy and let it cure for 24 hours. The bond hasn't cut loose for over a year and has survived three portable contest operations.

In actual use, the power output will vary anywhere from 60 to 100 Watts with 6 to 10 Watts of drive. As stated earlier, the input circuit doesn't look like 50 Ohms, but this wasn't critical in the original design as one cavity drove another and there was power in abundance. If you use this amplifier with a solid-state final, you might find the efficiency somewhat worse—most likely due to the ALC circuit protecting the transistors as it senses the high swr.

A useful gadget here is a 50-Ohm line stretcher, which is nothing more than a 10-inch piece of 50-Ohm rigid line with two sliding taps on it—a matching transformer of sorts! Mine came via Steve who found it at a flea market for under $10. I adjust the two taps for maximum power output on the exciter (a result of a good match) and am able to drive my amplifier to 80 Watts output with 8 Watts of drive. If you can't find a stretcher, you'll probably see only 6 dB or so of amplification, but that will yield 40 Watts for 10 Watts of drive . . . useful in any application.

In Conclusion

One last point—it's imperative that you use a good 50- Ohm relay at the output. Dow Key relays with type-N connectors will do the job very well. A DK-77 with BNC connectors has a bit more through-loss but is cheap—typically $10 apiece at flea markets—and will suffice. I use a brand new Dow Key model 260 which was extremely expensive. Here's a relay that sold for under $25.00 15 years ago and now retails for $200!! Oh well, when you've got the franchise. . . .

Now the catch: finding a cavity. These assemblies originally came from Fair Radio Sales and they have been known to pop up at flea markets from time to time. I have seen such units at Dayton in the past, but rest assured they don't sit on flea market tables for very long! Knowledgeable UHF types gobble 'em up right away, since one chassis yields two amplifier cavities and one mixer cavity. If you happen to find a mixer cavity, simply terminate the unused port with a 50-Ohm pad or load. Microwave loads are easy to find and will cost about $5-15 dollars each.

All in all, the Adler UHF Cavity will yield solid performance on 1296. Suggestion: Replace the 2C39A with a 3CX100 (if the cavity didn't already come with one) for a bit more output. Don't use 2C39s, as they are glass tubes and performance falls off drastically at this frequency! Both 2C39A and 3CX100 types are ceramic triodes and carry full ratings to 2 GHz, but the 3CX100 has a bit higher plate dissipation rating. You can find them at flea markets for a reasonable sum. ■

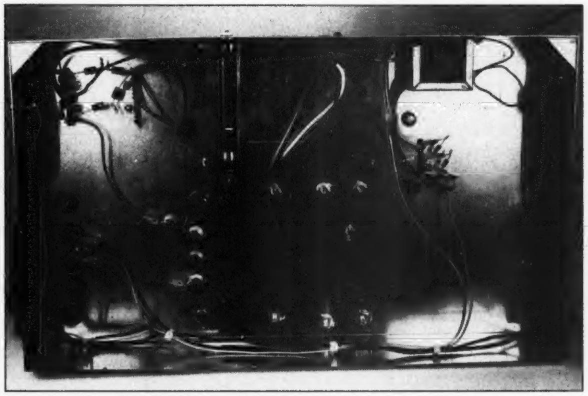

Photo D. View of the chassis underside.

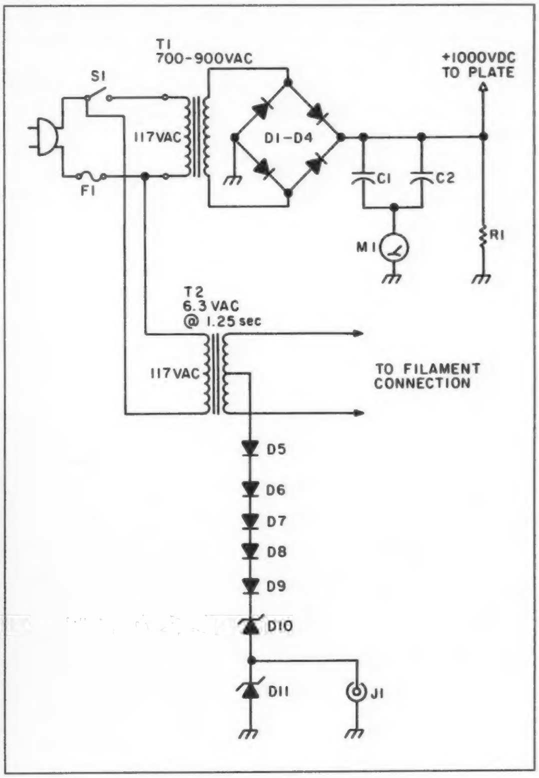

Figure 1. Power supply schematic.

Joseph J. Carr K4IPV
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Linear IC Amps

Using them without abusing them.

In 1966 I worked as an electronics technician repairing stereo amplifiers and receivers. One day, while working on an H.H. Scott receiver (one of the better brands in those days), I came across a series of semiconductor components in the FM i-f stage that looked funny. They looked like plastic epoxy transistors with six bug legs sticking up in the air. At first perplexed, my mind snapped into gear as I remembered an article on the then-new integrated circuits (ICs). What I was looking at was one of the earliest examples of a uA-703 i-f/rf gain block IC device. Shortly thereafter I discovered the first IC operational amplifier, the uA-709 (which cost $80 then, and goes five for a buck now). The uA-709 was truly revolutionary.

There are few who would argue that the integrated circuit has not revolutionized the entire electronics industry. Virtually unknown a couple of decades ago, the IC chip brought us both the extreme miniaturization of electronics circuits and previously unheard-of component densities. It is unlikely that the miracles of modern electronics—from cardiac pacemakers to the moon-landing program; from consumer entertainment electronics to the most massive fifth-generation supercomputers; from VCRs to multi-talented ham rigs that work from dc to daylight and cram more capability into a lunch box than we old guys put on a whole desktop—would have come into existence without the little chip.

Device performance was also improved by IC construction. Let's consider thermal drift of dc amplifiers. Even low-cost modern IC operational amplifiers are several orders of magnitude better than traditional vacuum tube or discrete transistors models because all of the semiconductors and internal resistors (the main sources of drift) share the same thermal environment in ICs. In discrete circuits, those components are spread out over several square inches of circuit board and thus do not share the same thermal enviroment—so drift is more pronounced than in the IC version of the circuit.

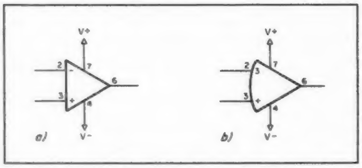


Fig. 1 Standard op amp signals.

Low cost is another great advantage of the integrated circuit. Early transistor and vacuum tube operational amplifiers were not only larger and ran hotter than their modern ICcounterparts—they were more costly as well. In addition, those early amplifiers only poorly approximated the performance of the ideal textbook version of the amplifier. Modern IC operational amplifiers come so close to the ideal (especially premium types) that textbook authors no longer look like fakers to those readers who try to translate theory into workbench practice.

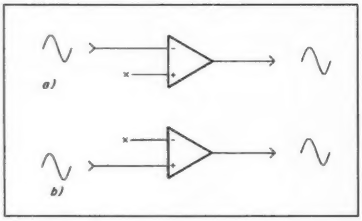


Fig. 2. a) shows inverted output; b)'s output is noninverted.

The first ICs appeared in the mid-1960s, and were low-density devices (the uA-703 mentioned above, for example). But as industry learned the trade, the number of active devices on the chip skyrocketed. Today, medium-scale integration (MSI) and large-scale integration (LSI) are the norm—and superscale-integration devices loom on the horizon as the frontiers of technology move forward under the onslaught of the quantum cooks of Silicon Valley.

Operational Amplifiers

The operational amplifier (OA) is the most commonly used linear IC amplifier in the world. Originally, the first vacuum-tube OAs were designed to calculate mathematical operations in old-fashioned analog computers, hence the name operationa amplifiers sticks today. The IC form of OA today is so widely used that it no longer has any significant role in the all-but-obsolete analog computers of yesteryear. The range of other applications for the OA is, however, truly awesome—it has become a mainstay of more audio, communications, TV, broadcasting, instrumentation, control, and measurement circuits than anyone can imagine.

The circuit symbols for the operational amplifier are shown in Fig. 1. The symbol shown at (a) is by far the most commonly used, and will be used here unless otherwise specified. This same symbol could also be used to represent any amplifier with differential inputs, but here will be used as the only proper symbol for op amps. The symbol shown at (b) is also seen occasionally, and some people regard it as the only proper symbol for operational amplifiers. The IEEE standard for circuit symbols, as well as industrial semiconductor companies such as Burr-Brown Corporation, specify the symbol shown at (b).

There are two input pins on the typical OA. The inverting input (-) produces an output signal that is 180-degrees out of phase with the input signal—see (a) in Fig. 2. Here we see a positive input signal producing a negative output signal, and vice versa. The noninverting input (+) produces an output signal that is in-phase with the input signal—(b) in Fig. 2. In the various applications shown in this article we will use either or both inputs.

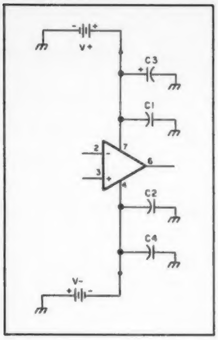


Fig. 3. Op amp powered by a bipolar dc supply.

An amplifier that uses only the inverting input is called an inverting follower, while the amplifier that uses only the noninverting input is called a noninverting follower (why the term follower is used no one under sixty seems to remember—and quite a few over-60 people probably never knew). An amplifier that uses both inputs might be a summer amplifier in some cases, but it is more likely a differential amplifier. That is, it produces an output signal that is a function of its gain and the difference between two input signal potentials.

The operational amplifier normally operates from a bipolar dc power supply, such as shown in Fig. 3. (The pin numbers in this figure are for the so-called industry standard 741-device.) This circuit shows that the two dc power supplies are independent of each other. The V− power supply is positive with respect to common (or ground), while the V− supply is negative with respect to the common. The operational amplifier manufacturer will specify minimum values for V− and V+. Typically, the maximum voltages will be on the order of ± 18 volts, with some offering ± 22 volts. (In one case a ± 40 volts was advertised.)

It is reasonably easy to supply a missing potential.

There may be certain limitation on the maximum supply voltages that do not show up at first glance, especially in the short-form specification or data sheet that hobbyists are usually given. For example, the most common limitation is the (V−) to (V+) potential. The manufacturer will specify that the quantity (V+) − (V−) does not exceed a certain potential. On some 741 devices, for example, the V− and V+ ratings are both 18 volts. But that does not mean that the algebraic sum of the two is 36 volts! The pin-to-pin supply voltage is not to exceed 30 volts. Since (+18 V dc) − (−18 V dc) is 36 volts, operating both terminals at their maximum voltage is not permitted.

Let's look at a practical example. Suppose we wanted to operate V+ at 18 volts. What, then, is the maximum value permitted of V− that will not exceed the pin-to-pin limit?

$$(V+) - (V-) = 30$$
$$(+18\ \text{V dc}) - (V-) = 30$$
$$-(V-) = 30 - 18$$
$$-(V-) = 12;\ \text{therefore}$$
$$(V-)\text{max} = 12.$$

Because most practical circuits operate with equal bipolar dc power supplies, it is also true that most of those using popular operational amplifiers with the 30-volt limit also limit the V− and V+ dc power supplies to not more than 15 volts each.

Single Supply Operation

The operational amplifier is intended for dual or bipolar power supply operation. There are, however, many applications where only one polarity dc power supply is available. In order to operate the op amp in these cases we must either supply the missing potential or devise a method for getting around the need for the missing potential.

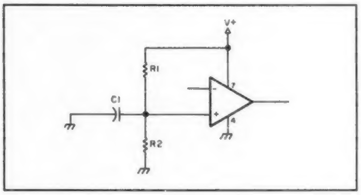


Fig. 4. Voltage divider circuit to power an op amp with a single supply.

It is reasonably easy to supply a missing potential. All we need is to add a dc-to-dc converter circuit that provides the needed voltage from the existing voltage. There are quite a few devices on the market that will produce either −15 volts from +15 volts (or 12 volts, as the case may be), or will produce isolated ±15 volt potentials from an existing non-isolated +15 volt potential. A popular version of this type of circuit is seen in hobbyist magazines from time to time. It uses a 555 IC timer device operated at or near 100 kHz, and a rectifier/filter circuit to produce a negative voltage. Of course, a voltage regulator can be added if needed. Typically, negative regulators will be on the 79xx or LM-320-xx series.

Another method for using a single dc power supply is shown in Fig. 4. Here we use a resistor voltage divider, R1/R2, to bias the noninverting input of the operational amplifier to some potential between ground and V+. The V− terminal of the op amp is grounded. The bias voltage on the noninverting input also appears on the output terminal as a dc offset potential. Unless the following circuit somehow doesn't care about this offset potential, the output must be capacitor coupled. The value of the bias voltage is found from:

$$V1 = \frac{(V+)\,R2}{R1 + R2}$$

The capacitor shown in Fig. 4 is used to place the noninverting input at our near-ground potential for ac signals, while retaining the dc level produced by the resistor voltage divider. This capacitor sometimes causes noisy operation of the op amp, so is often omitted in practical circuits. The value of the capacitor is such that it has a capacitive reactance of less than R2/10 at the lowest frequency of operation. For example, if the amplifier is designed to work down to 10 Hertz, and the value of R2 is 2200 Ohms (a typical value in real circuits), then the value of C1 must be such that it has a reactance of 220 Ohms or less at 10 Hz. This requirement evaluates to:

C1 = 1,000,000/(2 And F X)
C1 = 1,000,000/[(2)(3.14)(10 Hz)(220 Ohms)]
C1 = 1,000,000/13,816C1
C1 = 73 uF

Because 100 uF is the next higher standard value capacitor, most designers will select 100 uF for C1 instead of 73 uF.

A relatively recent form of IC linear amplifier is the Norton amplifier, also known as the Current Difference Amplifier (or CDA). The CDA produces an output voltage that is proportional to the difference between two input currents. The operation of the CDA is not exactly analogous to the op amp (i.e. with the input voltages replaced by input currents), so will not be detailed here.

The symbol for the CDA differs from the normal op amp symbol in order to distinguish its unique operation. The CDA symbol shown in Fig. 5 is the regular differential amplifier symbol with a current source symbol added along one edge to let the reader know that current mode is intended.

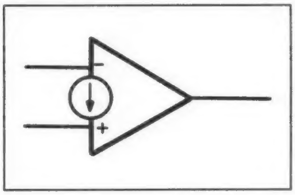


Fig. 5. Symbol for the CDA op amp.

Operational Transconductance Amplifiers (OTAs)

Another form of linear IC amplifier, different from either op amp or CDA, is the operational transconductance amplifier, or OTA. This type of amplifier has a transfer function that relates output current to input voltage. Since the transfer function expression has the units Amperes/volts (or sub-units thereof), the transfer function gain can be expressed in the units of conductance, mhos (or the sub-units millimhos or micromhos). Since these are units of conductance, I/V, we call the amplifier a transconductance amplifier. The name operational conveys the idea that some of the functions are similar to those of the operational amplifier.

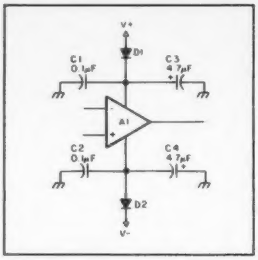


Fig. 6. Decoupling capacitors.

All in all it is better to use the alternative circuits using series diodes—but Fig. 8 is provided for the truly bold reader.

Operational and other linear IC amplifiers are sensitive to problems on the dc power supply. The amplifier may oscillate if not properly decoupled. Furthermore, variations and noise placed on the dc power supply lines in one stage can affect the other stages. Power supply rejection is not absolute.

We also find one other problem, especially in breadboarding and in portable (battery operated) equipment: reverse polarity dc power supplies. The results will be catastophic in that case! An operational amplifier with reversed dc power supplies will be destroyed instantly. Let's see how problems can be fixed in practical circuits.

The problems with noise and oscillation are cured with decoupling capacitors on the amplifier power supply terminals. Capacitors C1 and C2 (each 0.1 uF) in Fig. 6 are used to decouple high frequencies, while the low-frequency decoupling is provided by C3 and C4 (each 4.7 uF or higher). Now why do you suppose that two forms of capacitors are needed at each op-amp power supply terminal? That seems a bit odd, doesn't it? Why not just use the 4.7-uF capacitors—they are very much higher in value than the 0.1-uF units, after all.

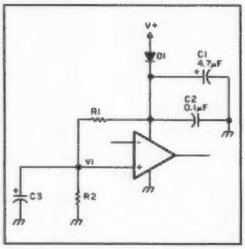


Fig. 7. Diode added to protect op amp from accidental reverse-polarization.

The higher value capacitors (C3 and C4) are typically aluminum or tantalum electrolytics. The performance of these capacitors drops drastically as frequency increases, and may well be zero at higher frequencies that are nonetheless within the range of most IC operational and other linear amplifiers. At those elevated frequencies, the typical electrolytic capacitor is about as effective as a block of wood. For this reason we also use a smaller value capacitor, but one that is of a type that will work at higher frequencies (e.g., mylar™, mica, ceramic, etc.). This situation is changing a little bit, however, as certain new forms of capacitor are now able to offer high-frequency operation as well as high capacitance.

One rule of thumb ensures the success of the circuit in regard to noise and oscillation: Place those capacitors as close as physically possible to the body of the amplifier. The 0.1-uF capacitors (C1 and C2) are more important than the higher value capacitors, so should be closest to the IC amplifier body.

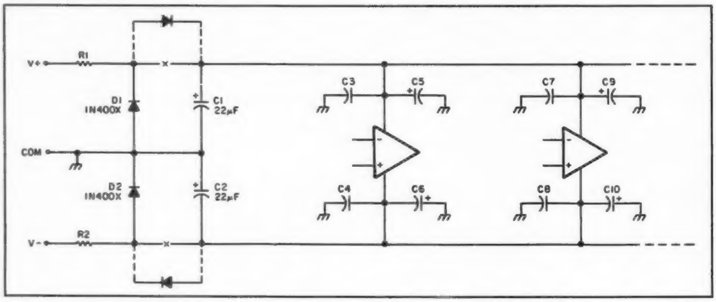


Fig. 9. Alternative uses of protective diodes. (C3, C4, C7, C8 are 0.1 uF; C5, C6, C9, C10 are 4.7 uF.)

The fix for reverse polarity conditions (apart from not doing it in the first place) is shown in Fig. 6 also. Diodes D1 and D2 are placed in series with each dc power supply line. Under normal operation these diodes are forward biased, so will conduct current to the amplifier. When some goof-ball (like me) accidentally connects one or both dc supplies backwards, then these diodes are reverse biased so will not conduct current. Thus, the series diodes protect the amplifier IC from someone's stupidity. Typical diodes for this application are any of the 1N400x series (1N4001-1N4007).

For single-polarity dc power supplies we need only a single diode, as shown in Fig. 7. Again, a 1N400x diode is both low cost and effective. In both cases (Figs. 6 and 7), it is imperative that the capacitors be used as well as the diodes.

A brute force method of protecting the amplifier is shown in Fig. 8. In this case, a zener diode is placed across the two dc power supply terminals of the amplifier. The zener potential must be greater than the maximum value of [(V+) - (V−)]. For a case where dc power supplies of ± 12 V dc are used, then this value is 24 volts. A 28-volt zener diode would be adequate, provided that the power supply voltages are reasonably stable. Under these conditions, with Vz greater than the voltage between the terminals, zener diode D1 is reverse-biased at a value lower than the zener potential. Thus, it is not used in normal operation.

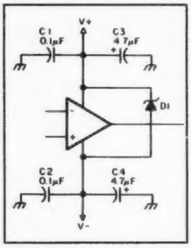


Fig. 8. For the "Bold reader."

In reverse polarity operation, diode D1 becomes forward biased in the non-zener mode. It will pass current around the amplifier harmlessly—hopefully. The big maybe is whether or not the zener diode will be destroyed. One solution is to use a very high value of power dissipation for D1. Another solution is to place a series resistor in the line with D1. All in all, it is better to use the alternative circuits using series diodes—but Fig. 8 is provided for the truly bold reader.

The protection of multiple amplifier stages is shown in Fig. 9. There are two alternatives shown in this figure. In one case, we could place 1N400x-series diodes across the power supply lines and series current-limiting resistors to prevent them from burning up. The diodes are normally reverse biased, but when one or both dc power supplies are reversed, then these diodes become forward biased—and short line to ground.

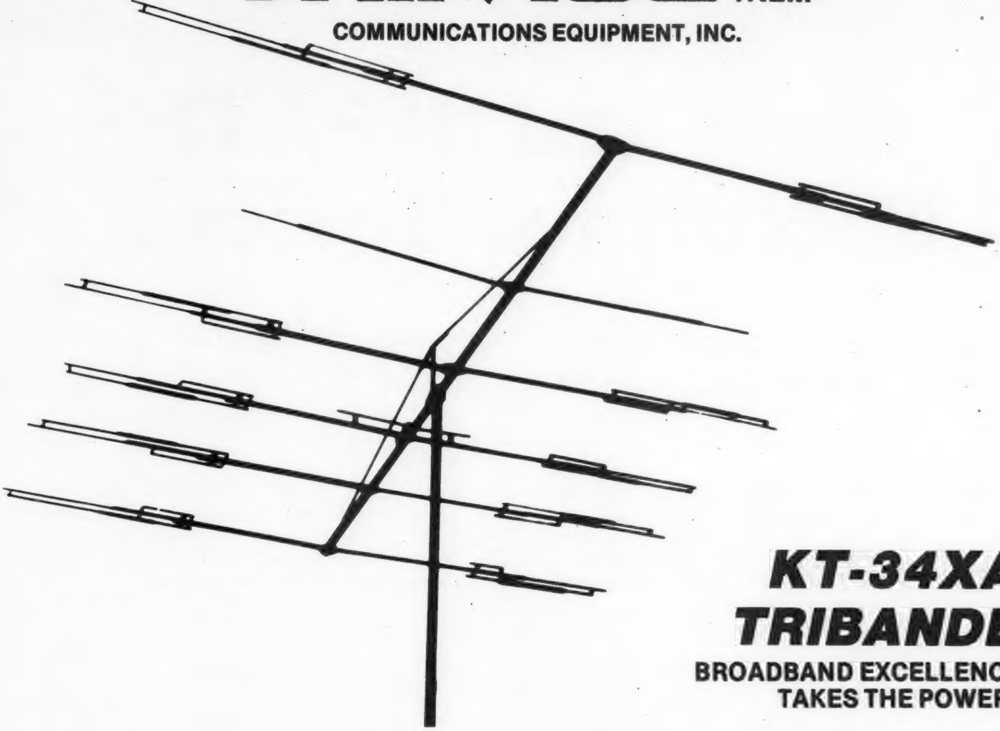
The second alternative is to place the diodes in series with the line at the power supply terminals (shown in dotted lines in Fig. 9). This method is analogous to the method of Fig. 6, except that it serves more than one amplifier.

Conclusion

We have discussed the operational amplifier, the current difference Norton amplifier, and the operational trans conductance amplifier. We have also covered amplifiers in general, and methods of protecting IC amplifiers. How to use these devices can be found in several different texts and, I am sure, on these pages from time to time. ■

MIRAGE /KLM

COMMUNICATIONS EQUIPMENT, INC.



KT-34XA TRIBANDER

BROADBAND EXCELLENCE THAT TAKES THE POWER

KLM's KT-34XA TRIBANDER is the 2nd generation of a unique new series of antennas designed to provide superior **broadband** coverage on 20, 15, and 10 meters. The combination of lossless linear loading and hi-Q air capacitors enables the KT-34XA to outperform **all** commercial available tribanders and meet or exceed the performance of a conventional stacked monoband system. The lower weight and windload of a single antenna mean reduced tower and rotator requirements. Thus, overall system costs can be kept to a minimum while enjoying the best of monobander-type performance.

KLM's field proven KT-34A is the heart of the "XA" model. The boom length of the "XA", however, has been doubled, and one triresonant and one full size 10 meter element have been added. These changes increase the gain to **11-11.3 dBd** on 10M, **9-9.5 dBd** on 15M, and **8.5-9 dBd** on 20M. Two driven elements are used to make the KT-34XA unusually broadbanded (a concept applied to many KLM antennas). Gain is virtually flat across each band except for 10 meters which has been optimized for the DX'er, 28-29 MHz. The chart shows the remarkable performance qualities of the KT-34XA.

The KT-34XA's design represents the first major advancement in tribander technology in over 20 years! The conventional traps, coils, and capacitors have been discarded in favor of integral linear loading and hi-Q air capacitors, all composed of aluminum tubing. These give the KT-34XA a conservative power handling capability of 4 KW PEP and an unusually high level of operating **efficiency**. Linear loading also makes full ¼-wave elements possible on 15 and 10 meters, and brings 20 meters much closer to the desirable ¼-wave than any conventional tribander.

BANDWIDTHS:	14.0-14.350 MHz 21.0-21.50 MHz 28-29 MHz	**GAIN:**	8.5-9dB 9-9.5dB 11-11.3dB
VSWR:	1.5:1	**BOOM LENGTH:**	32 ft. × 3″O.D.
FB/FS:	20dB/40dB	**TURN RADIUS:**	21.5 ft.
FEED IMP.:	50 ohms w/balun	**WINDLOAD:**	9 sq. ft.
BALUN:	3-60-4:1 5KW PEP	**WT. (LBS.):**	75 lbs.
ELEMENT LENGTH:	24 ft.	**MAST:**	2″ O.D. (standard)

Mechanically, the KT-34XA has been built to survive the toughest weather conditions. All aluminum, including the boom, is strong 6063-T832 alloy. All electrical hardware is stainless steel. Virtually indestructible "Lexan" insulators, just like those on KLM's 40 meter "Big Sticker," are used for mounting the elements and insulating them from the boom. KLM's 3-60 MHz 4:1 balun is supplied for direct connection to any 50 ohm feedline.

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San Diego CA 92119

Gunn and IMPATT Microwave Devices

The author shows how to safely test these diodes used in 10-GHz operation.

Over the past 20 years, microwave equipment has been changing over to solid-state devices at a very fast pace. Solid-state devices now dominate in the low- to medium-power ranges. I had been very comfortable with vacuum tube devices so it took some adjustment for me to switch from klystrons to diodes as microwave oscillators.

Vacuum tubes are forgiving—they give some indication before going self-destruct. Unfortunately, this is not the case with transistors and diodes, where it is often too late by the time you see the flash or smell the smoke. This one fact I believe has kept many from experimenting with them.

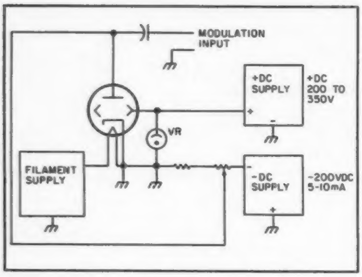


Fig. 1. Schematic for the klystron system.

I have outlined some procedures in testing surplus solid-state devices in a non-destruct environment—particularly, Gunn and IMPATT (IMPact Avalanche Transit Time) diodes for use on our 10-GHz microwave bands. The procedures described here will give an insight into how these devices operate and how to handle them.

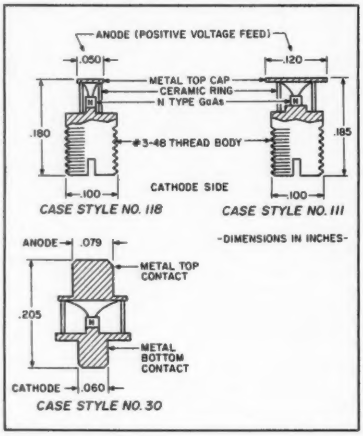


Fig. 2. Cross length section Gunn diodes in several typical packages.

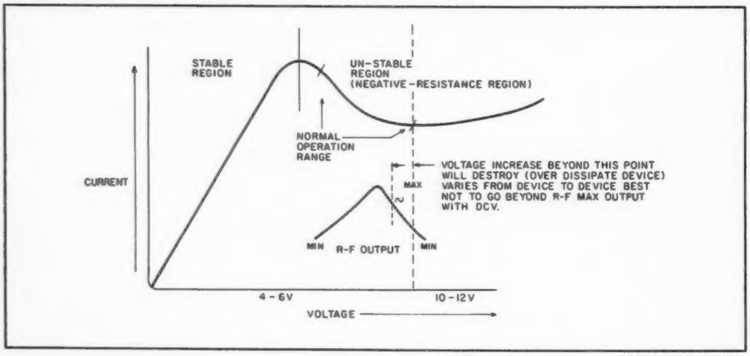


Fig. 3. Current/voltage plot for a typical Gunn diode. The diode starts to exhibit negative resistance at around six volts across it.

Klystron vs. Gunn

The klystron vacuum tube has been in use for quite a long time, and many pieces of test equipment still use the old reliable 723A/2K25-type tube. Three power supply voltages are required to operate the tube: B+ dc, B− dc, and filament. The power supply weight for this is at least 10 pounds, and not exactly portable. The power output of the average klystron was about 10 to 20 milliwatts. I have operated pieces of equipment producing 100-mW output, but they required boilers to carry away the heat produced in generating rf. The klystron system is bulky and non-portable (See Figure 1).

The obvious advantages to solid-state devices at microwave frequencies outweigh the high initial cost. A simple Gunn diode oscillator requires only a single low-voltage-dc supply. Let's examine what is required, just what constitutes a Gunn diode or IMPATT diode, and also what makes them different from each other, and how they operate to produce microwave energy.

Gunn diodes were named after J.B. Gunn of IBM, who in 1963 discovered a fluctuating current while testing a piece of Gallium Arsenide (GaAs). While it is held that he did not connect the microwave possibilities at the time, he did discover the effect first. Just prior to this, Ridley, Watkins, and Hilsum postulated the existence of negative resistance in semiconductors. They laid out the theory to a tee, but their attempts to prove it in the lab failed due to the purity of their specimen of GaAs. Another scientist, Kroemer, tied together the postulated theory and the fluctuating current observed in Gunn's experiments and declared they were one and the same: the theory and the proof of negative resistance. Gunn did not recognize the microwave oscillation because he was looking for noise in semiconductor materials, not rf.

This Gunn diode should be called a silicon or gallium arsenide resistor as in reality it does not have a P-N junction as normal diodes do. We all think of PNP and NPN transistors, and I even take for granted the diode. But all common diodes have a P-N junction—at least, detectors, rectifiers and multipliers.

Another factor making diodes suitable for microwave frequencies is their very short leads. This gives them a very low inductance and capacitance to present to the microwave circuits. Stray inductance and capacitance can make microwave circuits very hard to tame or not work at all. See Figure 2 for some typical packages used in microwave diodes. The screw terminal is the cathode in these devices. Microwave Associates lists a capacitance of .22 pF and an inductance of .16 nH for this 118 case/package at 10 GHz.

Microwave Gunn diodes as well as other types are quite small. The threaded side of the diode is used for connection in the heat sink for dissipation, and is given a good contact with the surface with a small dab of heat sink compound. The efficiency of these diodes is low, less than about 20%, but considering the ease with which they can be made to operate, one can overlook that. The wafer-thin piece of Gallium Arsenide is attached to one end of the heat sink post (see Figure 2) and covered by a .050-inch ceramic sleeve. The top of the GaAs is attached with ribbon contacts and put on top of the sleeve for fixing to the top cover plate for the contact to the dc supply feed. This post is the anode in the diodes that I have. It can be reversed, but that is by special order from the original supplier of the diodes.

Gunn Operation

This wafer-thin GaAs Gunn diode is mounted in a suitable microwave cavity or waveguide and coupled to a source of dc voltage, positive to the anode. When the voltage is adjusted to some critical value, microwave oscillation will take place and is controlled by the dimensions of the waveguide and post connecting the diode. The resistance of the diode varies but is in the range of 1 to 10 Ohms in samples I have tried. Gunn diodes are driven with a constant voltage supply. This allows them to have all the current they want as long as the voltage is held to some special value, usually under 12 volts.

Testing different Gunn devices, I slowly raise the voltage from a supply made from a LM-317 adjustable regulator mounted near the device. As the voltage is increased, the current is increasing in proportion to the voltage until a critical point, when a slight increase in voltage produces a slight decrease in current. At this magic point (somewhat different for various devices) this is the negative resistance region where microwave oscillation is starting to take place.

This voltage is in the area of 4 to 6 volts for most diodes; it varies quite a bit. The upper voltage limit is not very high, and the maximum voltage on the highest device that I have is about 18 volts. I might suggest preventing destruction by not going above 9 to 10 volts until you are sure of what you have. Keep the voltage low, and the diode will be fine. Keep going only if you really need to know where breakdown is located.I have destroyed many devices in pursuit of this knowledge. Onerule I have discovered is that if the diode starts oscillation on a low voltage, say 4 volts, its maximum voltage will be around 10 to 12 volts; or those starting around 5.5 volts, the max is 14 volts. Most Gunn diodes available on the surplus market today have a top voltage of 12–14 volts dc.

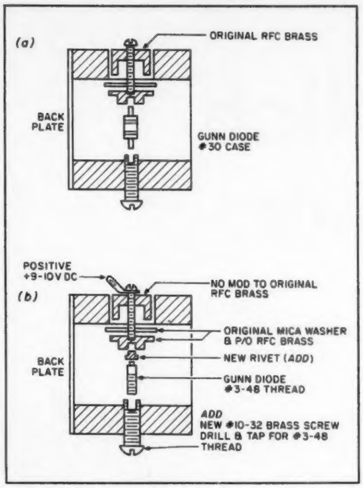

(a)
ORIGINAL RFC BRASS
BACK PLATE
GUNN DIODE #30 CASE
POSITIVE +9-10V DC
(b)
NO MOD TO ORIGINAL RFC BRASS
ORIGINAL MICA WASHER & P/O RFC BRASS
NEW RIVET (ADD)
BACK PLATE
GUNN DIODE #3-48 THREAD
ADD NEW #10-32 BRASS SCREW DRILL & TAP FOR #3-48 THREAD

Fig. 4. SOLFAN Cavity Modifications.

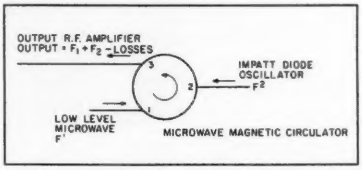

OUTPUT R.F. AMPLIFIER
OUTPUT = F1 + F2 − LOSSES
3
IMPATT DIODE OSCILLATOR
2
F2
1
LOW LEVEL MICROWAVE F1
MICROWAVE MAGNETIC CIRCULATOR

Fig. 6. Amplification using an IMPATT diode oscillator.

This point of negative resistance is just inside the unstable region of the diode's curve. What is happening is that the current inside the Gunn diode GaAs wafer is being bunched up and arrives on the other side of the material in a pulse of current. The period of this pulse is the microwave frequency of operation and can also be adjusted by varying the voltage within this unstable area (see Figure 3).

As the voltage is increased past this starting point of oscillation, current still increases but not in such a direct manner as before oscillation. The output power of the Gunn device is increasing until some further point when a further increase will produce a decrease in rf power output. If the voltage is increased further, a point will be shortly reached which will be very near the destruct voltage of the device. Note that 1/2 to 1 volt beyond maximum rf, output will put you near that region.

My diodes put out power in the 100–250 mW range and operate with 8.5 to 10.5 volts, drawing about 600 to 850 mA of current. A good heat sink or large metal cavity is required for long-term operation and device stability. I have violated this point on occasion and lost several expensive diodes.

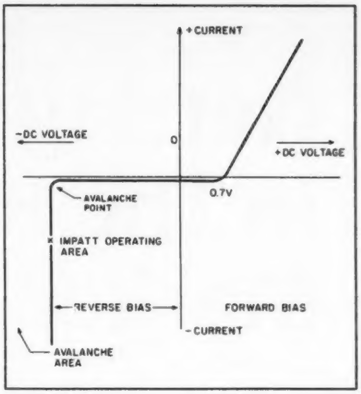


Fig. 5. Typical current/voltage curve for an IMPATT diode.

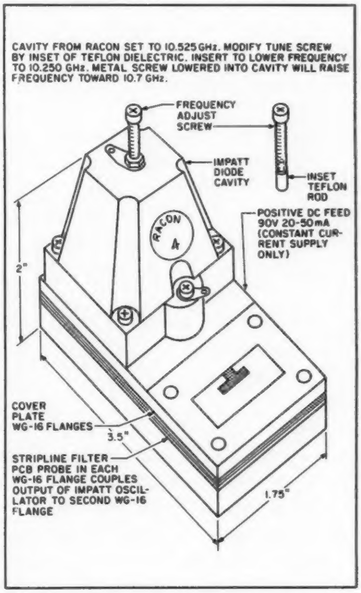
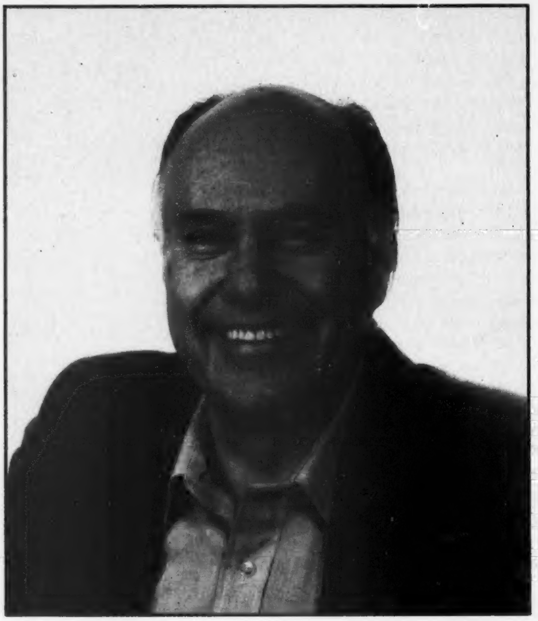

CAVITY FROM RACON SET TO 10.525 GHz. MODIFY TUNE SCREW BY INSET OF TEFLON DIELECTRIC. INSERT TO LOWER FREQUENCY TO 10.250 GHz. METAL SCREW LOWERED INTO CAVITY WILL RAISE FREQUENCY TOWARD 10.7 GHz.
FREQUENCY ADJUST SCREW
IMPATT DIODE CAVITY
INSET TEFLON ROD
POSITIVE DC FEED 90V 20-50mA (CONSTANT CURRENT SUPPLY ONLY)
RACON
A
2"
COVER PLATE WG-16 FLANGES
3.5"
STRIPLINE FILTER PCB PROBE IN EACH WG-16 FLANGE COUPLES OUTPUT OF IMPATT OSCILLATOR TO SECOND WG-16 FLANGE
1.75"

Fig. 7. RACON IMPATT source and filter.

The cavity I have experimented with is the SOLFAN mount, a cast metal cavity with the diode mounted in the center of a large block of metal. This cavity was intended to be run at 10 mW, with a 200-mW diode (+23-dBm output). It gets quite hot after about a half hour of operation. You can hold it in your hand for a short time before it is uncomfortable. A better heat sink is needed for longer operating periods. A cavity temperature of 100–120 degrees Fahrenheit is normal, and for stability, maintaining a constant temperature will slow frequency drift and eliminate the variables resulting from temperature changes.

This cavity has to be modified slightly with

Getting Rich In The Ham Market



Every time two hams get together at least one says how about if we were to make this great product to sell to hams—not realizing that the ham "industry" is probably one of the best possible ways to guarantee poverty.

No, not all hams are cheap—not all are living on starvation retirement payments—the fact is that some ham firms are doing remarkably well selling to those few hams who are alive and well—and to the handful of newcomers who blunder into our hobby.

The whole trick to survival in the ham market is in getting your sales message to your potential customers —this is called marketing. Marketing includes making sure your literature is as good as (or even better than) your product—and that your sales pitch reaches those few live hams who are your best potential customers.

I'll bet you thought I was never going to mention *73*. Advertising is going to be one of your biggest sales expenses, so give it the serious thought it rates. Advertising is a very well-developed art—billions have been spent on research to find out what works and what doesn't. Indeed, I'm working on a video just on how to advertise. In the meanwhile, if you can take it, I'll mercilessly criticize your literature and your ads—a service no other ham magazine can provide at any price because none of them have anyone with anything even remotely like the 35 years I've had in advertising to hams. Unless you fall in it, it's unlikely you're going to find an ad agency able to help you sell to hams—which is, to be kind, a unique group.

Presuming that sales are of some importance to you, where do you think you'll do best? There are four ham magazines—one for advanced builders—one for contest fanatics—one for ARRL fans—and then there's *73*—which appeals to active hams with small construction projects, with the only world DX column, with columns and news about all of the new ham activities such as packet, RTTY, Oscar and so on. The *73* readers buy circles around other magazine readers because they're active and motivated.

So if you decide to try and fight the odds with a ham product, give it your best shot with *73*—and let me help you win with powerful, sales-oriented literature and ads. A little mail order business at home is a great way to become independent—millions are doing it. Remember, small business is the real strength of America . . . and it's about the only practical way to have a crack at making big money these days.

Write or call the *73* advertising people—Sam or Ed—and let's get you started with power ads which will make you money.

. . . Wayne
W2NSD/1

73 Amateur Radio • WGE Center • Peterborough, NH 03458 • (603) 525-4201.

the addition of a solid rivet placed in the rfc-dc-feed inside the cavity. I placed the rivet in the hole and tapped it lightly with a punch to seat it. It will not fall out of the cavity's rfc, but can be removed if you wish to replace the original 10-mW diode. To remove the rivet, pinch with small diagonal pliers and the rivet will pop free. A new 10/23 brass screw is drilled out and taped to accept the 3/48 threads of the high power Gunn diodes. (See Figure 4)

Although I have not tried this, I have heard about placing two Gunn diodes in parallel to achieve a higher power output than can be obtained from one device. They may be mounted in a waveguide and spaced 1/2-guide wavelength apart. Remind yourself that an oscillator injected into another will cause them to lock to a common frequency as long as the mechanical tuning is within the same frequency; the other will follow for a few MHz or so.

IMPATT Diodes

The case styles used in Gunn diodes and IMPATT diodes are so small that the manufacturers do not put part numbers on the devices—you have to be very careful looking at each device on the surplus market. An IMPATT diode is operated in the constant current mode. That is, the voltage is increased to some specific point where avalanche current breakdown takes place. Some means has to be found to limit the current to a prescribed value. One very sure way to destroy an IMPATT device is to test it as a Gunn diode. The IMPATT diode doesn't tolerate excessive current. See Figure 5 for IMPATT diode curves.

The IMPATT diode is a real P-N junction, and this device is operated reverse-biased with a high voltage breakdown to produce a supply of electrons and holes. The diode is quite similar to a zener diode but is doped with impurities to have a controlling effect on the avalanche current so necessary for its operation. In this unstable mode, the voltage is made variable in the 80–90-V range, and the current is limited to about 30–50 mA. This can be set with a fixed resistor. The IMPATT diode has a critical voltage where microwave oscillation will take place somewhat like the Gunn description. The IMPATTs that I have oscillate at about 82.5 volts dc with 50 mA and an output of 100 mW at 10 GHz.

The IMPATT diode is termed an Avalanche Effect device. What is going on is the holes and electrons are involved in Impact and Ionization within the P-N junction and produces a negative resistance at some critical voltage with controlled current supplies. IMPATT operation happens when the voltage of the ringing waveform through the diode adds with the dc bias and causes the junction to go into the avalanche mode.

If the device is biased properly, the junction will produce output on half of the duty cycle. In this case, the IMPATT diode is biased just above the point of avalanche, and when rf swings positive the avalanche current (which builds up slowly) reaches its peak when the rf voltage is zero. This repeated operation produces a current pulse traveling toward the anode. This type of operation is very noisy and is not suitable for local oscillator use in a receiver. It does produce quite an output, and the high voltage required for operation makes them somewhat less desirable than the Gunn diodes for portable operation.

IMPATT Amplifiers

IMPATT diodes are used in amplifiers, and the commercial applications are numerous. The IMPATTs are operated (CLASS C) but from where I sit, their construction appears to be little less than black magic. What they do is run the IMPATT diode and couple low-level rf into a circulator which couples the energy to the port that the IMPATT is at. The low level rf and the output of the IMPATT (adjusted very near the input frequency) become locked to the input source and combine, producing a reproduction of the input signal at a higher power level (Figure 6).

We have been toying with the idea of using a RACON IMPATT source and filter in a 10-GHz beacon so that many stations could use it at their convenience to tune and test systems. By having the IMPATT source at someone's home, the problem of high voltage power is minimized. I was very fortunate to be able to pick up several of these RACON sources new, and plan to use one for our San Diego Microwave Group's beacon. See Figure 7 for details on the IMPATT cavity and filter used. This low-cost source is available from RACON. This device is made to operate at 10.525 GHz (pn 10000-104-02) with a wide band filter 8.2 to 12.4 GHz (pn 10000-109-01). The last price list I have from RACON lists the IMPATT source and filter at $60. (RACON, 8490 Perimeter Rd., S. Seattle WA 98108.)

Projects in the future include a simple home-made transmitter receiver out of items easy to obtain (the hardest of these to find is 1"-round Teflon® stock.) It has become very easy to generate rf at appreciable power, but it was somewhat difficult to achieve good receiver sensitivity—at least prior to current design.

Other projects in the very near future are some test equipment and i-f preamplifiers using low-cost devices. All projects have been the direct result of many hours of experimenting and field trials with each one making our equipment easier to use or improved in operation.

I can make available high-power Gunn diodes, case style 118 with silver brass rivets, operating at 10 GHz with measured power output better than 50 mW to aproximately 100 mW, for $5 each, postpaid in the continental U.S. Some select higher power devices are available for 6, 10, and 18 GHz. Power output varies from one cavity design to another. I would be happy to answer any questions regarding this or other related projects, but please enclose an SASE for prompt reply. ■

HAM HELP

We are happy to provide Ham Help listings free, on a space-available basis. To make our job easier and to ensure your listing is correct, please type or print your request clearly on a full (8-1/2 x 11) sheet of paper. Double-space and use upper- and lowercase letters where appropriate. Also, write numbers carefully—a 1, for example, can be read as an l or an i or a 7 as a 1. Thanks for your cooperation.

I am looking for a receiver for the 225–400 MHz AM Military aeronautical band. I know that there are several continuous coverage scanners available, but they are $350 up—do you have something cheaper?

Doug Graham
4929 Elm
Arcadia TX 77517

I need service info for the following items and will purchase or pay for the copying costs: Unicom Electronics power supply Model PS-11R, Tandy 64K Color Computer II, Model 26-3127, EMP/GTS Manual Mini Modem Model MM-101 (manufactured by Elec and Eltec Co., Hong Kong), Heathkit Oscilloscope Calibrator Model IG-4505, Leader rf signal generator Model LSG-11, Garrard Turntable Model Lab 95B, Johnson Messenger CB Model 323, Apple IIe Pro System Duo-Disk Imagewriter PrinterMonitor II, and ICOM IC-735 Transceiver.

Mike Adams—Haney Vo-Tech Center
3016 Hwy 77
Panama City FL 32405

I am looking for the following items (please state price and/or condition in correspondence): Two transistors MRF 455 A; an MFJ-962, -949C, -941D, or 989 antenna tuner: five 7868 tubes; ten #12 6-V lamps for Bogen PA Amps; one bandswitch each for the Panasonic rf 2800 receiver #RSR 98W or equivalent; one printer and disk drive for the Tandy Color Computer II Model 26-3127: and one Z-80/CPM and Modem Board for the Apple IIe Pro System.

Mike Adams—Haney Vo-Tech Center
3016 Hwy 77
Panama City FL 32405

Wanted: External Frequency Display YC-7B for the Yaesu FT7B.

Bill Parker W4YKW
3154 Ravenwood Dr.
Falls Church VA 22044

Robert Dennison KB4MDR, G8GNC
625 Shadywood Lane
Raleigh NC 27603

Satellite TV Receiver Components

These make versatile building blocks for 23cm projects.

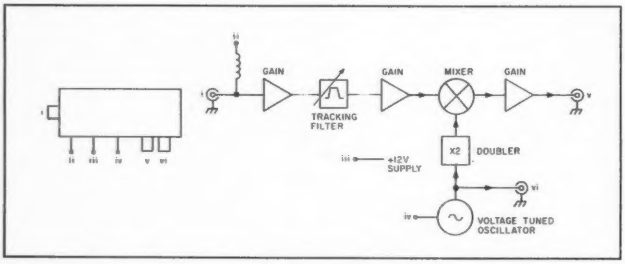

ii
i
ii
iii
iv
v
vi
i
GAIN
TRACKING FILTER
GAIN
MIXER
GAIN
v
iii
+12V SUPPLY
X2
DOUBLER
vi
iv
VOLTAGE TUNED OSCILLATOR

Fig. 1. i. 950 to 1450 MHz input (F connector). ii. To place a dc voltage on the center conduction at i. Normally used for powering an LBN (low noise block converter). Could be used for powering a preamp in amateur applications. iii. 12-V dc supply (should be regulated). iv. Tuning voltage. Tunes the oscillator and front end tracking filter. The oscillator operates on the high side at half the required frequency, i.e., (f in + 70)/2 MHz. The tuning voltage is typically 3 V at 950 MHz, 18 V at 1450 MHz, and 12 V at our 1250 MHz. The curve is quite close to being linear. v. The 70-MHz i-f output (RCA connector). Overall bandwidth of front end tracking filter and 70-MHz output is at least 25 MHz. vi. Oscillator output for phase-locking applications (RCA connector) level is approximately −20 dBm.

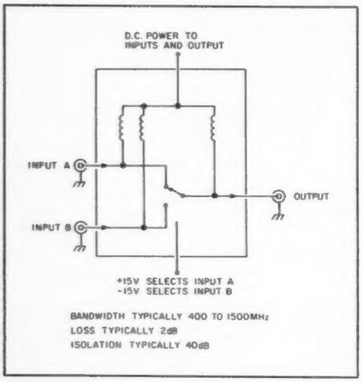

D.C. POWER TO INPUTS AND OUTPUT
INPUT A
INPUT B
OUTPUT
+15V SELECTS INPUT A
-15V SELECTS INPUT B
BANDWIDTH TYPICALLY 400 TO 1500MHz
LOSS TYPICALLY 2dB
ISOLATION TYPICALLY 40dB

Fig. 2.

Modern block conversion satellite receivers in the 3.7- to 4.2-GHz band most commonly have a first i-f of 950 to 1450 MHz. Our 23-cm band of 1240 to 1300 MHz is conveniently located within that band. Not surprisingly, the mass production of these receivers has brought some very useful components within reach of the radio amateur. The use of these components as building blocks for 23-cm projects takes away most of the technical difficulty of designing and constructing at this frequency. Some of the most useful components are:

1. The Satellite Receiver Front End—A typical example is the Mitsumi (Japan) TIF A52F tuner shown in Fig. 1. This unit converts 950- to 1450-MHz signals to 70 MHz.

2. Electronic PIN Diode Switches—In their satellite receiver application, these are used for selecting between two 950- to 1450-MHz signals, one for receiving horizontally-polarized transmissions, one for receiving vertically-polarized transmissions. Chokes and rf decoupling are often provided between input and output to facilitate dc powering. Frequency coverage of the switch is typically 400 to 1500 MHz, so applications on the 70-cm and 23-cm bands are possible. See Fig. 2.

3. Final I-f Filters: 70 MHz is the most

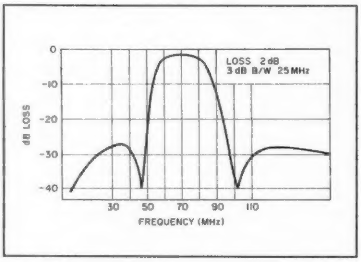


Fig. 3.

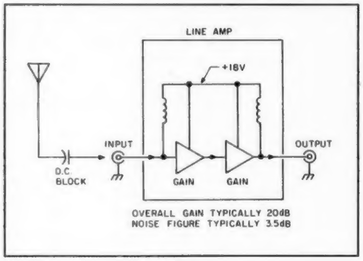

LINE AMP
+18V
INPUT
OUTPUT
D.C. BLOCK
GAIN
GAIN
OVERALL GAIN TYPICALLY 20dB
NOISE FIGURE TYPICALLY 3.5dB

Fig. 4.

common final i-f in satellite receivers. The bandwidth is normally around 25 MHz. A typical response curve is shown in Fig. 3. This could serve as a roofing filter in an intermediate i-f in multiple conversion systems. Note that the bandwidth covers approximately 58 to 82 MHz, so TV channel 3 (60 to 66 MHz), channel 4 (66 to 72 MHz), and channel 5 (76 to 82 MHz) will be passed. This gives many possibilities for amateur television use.

4. 950- to 1450-MHz Line Amplifiers—These are designed to overcome the cable attenuation when long runs of cable are used. Typical gain is 20 dB with a noise figure of 3.5 dB. For use as a preamp, that noise figure is only fair, but it makes a good starting point. These units are powered from +18 V on the center of the coax, so if you are using an antenna which is a dc short, you need a blocking capacitor on the input of the preamp. Female "F" connectors are used on the input and output. Note, it may be necessary to put a 23-cm band filter ahead of this amplifier to prevent intermodulation, particularly from local UHF TV stations.

Using the Components

The remainder of this article describes some of the possibilities of using these components for 23-cm projects in areas such as amateur TV (AM or FM), 23-cm receivers, and 23-cm repeaters (linear, FM or TV). Note that for high sensitivity receiver applications, a preamp will be necessary as the above-mentioned front end has a noise figure of typically 14 dB, but a preamp with 20-dB gain and 3.5-dB noise figure will give a system noise figure of approximately 3.9 dB.

1. High Stability Receiver For All Modes 1280 to 1300 MHz (Fig. 5). 1280 to 1300 MHz is the primary area of the 23-cm band for weak signal work. The preamp defines system noise figure. At first i-f, 1300 MHz will become 60 MHz, 1290 MHz becomes 70 MHz and 1280 MHz becomes 80 MHz. All pass through the 70-MHz filter. The LO in the front end is: (1290 + 70)/2 = 680 MHz.

To phase-lock it to that frequency in the block diagram shown, X_1 should be 680/64 = 10.625 MHz.

The 70-MHz signal is then converted to 20 MHz; 60 MHz to 30 MHz, and 80 MHz to 10 MHz. This requires X_2 be 70 + 20 = 90 MHz. Note that the two high-side oscillators give us two inversions (= no inversion). The 1280- to 1300-MHz band can now be tuned in at 10 to 30 MHz with sidebands the original way around, on a general coverage receiver.

2. Amateur Television (AM) Receiver—The receiver of Fig. 6 simply downconverts the 23-cm signal to a 70-MHz signal, where it can be received on a TV set tuned to channel 4. If channel 4 is occupied in your area, channel 3 or 5 will also work due to the bandwidth of the unit. The front end is not phase-locked as there is no need to worry about frequency stability because: (a) The front end is inherently quite stable, (b) Television is a wideband mode, and (c) The television set's afc will operate at channel 4. The major disadvantage of the system in Fig. 6 is spectrum inversion due to the high side LO, though this is not a problem if the transmission is double sideband. Fig. 7 shows a receiving system which eliminates the problem by using a second conversion, again with a high side LO to return the sidebands back the right way around. The example shows converting a 1247- to 1253-MHz signal to UHF channel 16 (482 to 488 MHz), though a high VHF channel could also have been used. Again, no need to worry about oscillator stability or exact frequency as the television receiver's afc will take care of it.

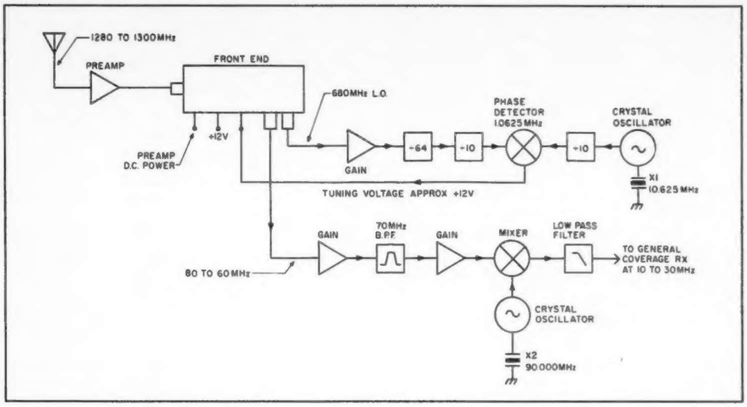

1280 TO 1300MHz
PREAMP
FRONT END
680MHz L.O.
PHASE DETECTOR 1.0625MHz
CRYSTAL OSCILLATOR
+12V
PREAMP D.C. POWER
GAIN
÷64
÷10
÷10
X1 10.625MHz
TUNING VOLTAGE APPROX +12V
GAIN
70MHz B.P.F.
GAIN
MIXER
LOW PASS FILTER
TO GENERAL COVERAGE RX AT 10 TO 30MHz
80 TO 60MHz
CRYSTAL OSCILLATOR
X2 90.000MHz

Fig. 5.

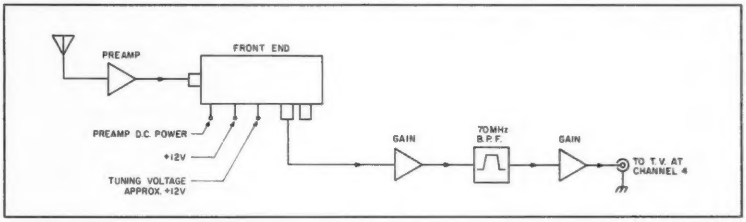

PREAMP
FRONT END
PREAMP D.C. POWER
+12V
TUNING VOLTAGE APPROX. +12V
GAIN
70MHz B.P.F.
GAIN
TO T.V. AT CHANNEL 4

Fig. 6.

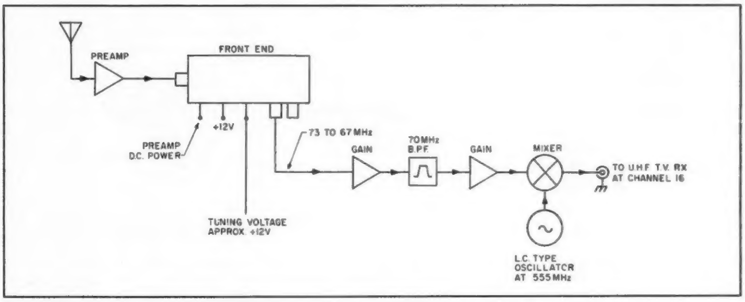

PREAMP
FRONT END
+12V
PREAMP D.C. POWER
73 TO 67MHz
GAIN
70MHz B.P.F.
GAIN
MIXER
TO UHF T.V. RX AT CHANNEL 16
TUNING VOLTAGE APPROX. +12V
L.C. TYPE OSCILLATOR AT 555MHz

Fig. 7. Example shows 1247-MHz-to-1253 MHz TV channel.

3. Variable Antenna Pattern for 70 and 23 Receivers (Fig. 8). A typical application could be switching between an omni-directional antenna and a yagi in a repeater receiver. The PIN diode switch described at the beginning of this article will select one of the two inputs, according to whether +15 V or −15 V is applied to it. Note that each antenna has a preamp ahead of the switch so that the switch's 2-dB loss does not hurt the system noise figure.

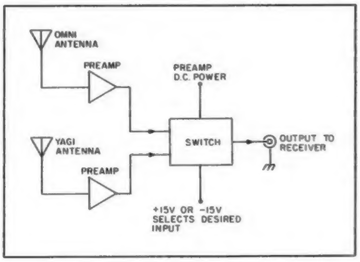

OMNI ANTENNA
PREAMP
PREAMP D.C. POWER
YAGI ANTENNA
SWITCH
OUTPUT TO RECEIVER
PREAMP
+15V OR −15V SELECTS DESIRED INPUT

Fig. 8.

4. 23-cm Repeater Receiver (Fig. 9). This design can apply to FM repeaters or linear transponders. The block diagram is identical to the high stability receiver with the center of the desired channel being converted to 10.7 MHz. At the 10.7- MHz output, a filter of

appropriate bandwidth is included. In FM repeaters, this will be a 16-kHz filter. The signal will then be amplified, limited, and detected in the usual manner. In a linear transponder, an appropriate bandwidth filter will be followed by conversion to the desired output frequency.

5. FM Video Receivers (Fig. 10). FM video, like that used on satellite TV signals, is superior to AM video for weak signal work due to the FM improvement factor. The big disadvantage is the wide bandwidth occupied. By placing the 950-to-1450-MHz tuner ahead of a 70-MHz satellite TV receiver, we have a receiver for FM video in the 23-cm band. Note that in a block conversion satellite receiver with 950- to 1450-MHz i-f transponders, 8, 9, and 10 fall at 1290, 1270 and 1250 MHz, respectively, opening the way for ready-made receivers, especially if we place our audio on a 6.8-MHz subcarrier!

6. Place the receiver in the shack and use cheap coax! It is most convenient to have our equipment indoors (temperature, weather, etc.) but the best coax cable is very expensive and its loss would add directly to the system noise figure. RG-6 cable is cheap, readily available and has loss of about 8 dB per 100 feet at 1300 MHz. If a 20-dB gain, 3.5-dB noise figure preamp is mounted directly behind the antenna, and 50 feet of RG-6 cable run to the satellite receiver front end (noise figure 14 dB) in the shack, then the system noise figure will be approximately 4.5 dB (see Fig. 11). Note that the front end provides a pin for placing a voltage on the coax center conductor, which can be used for powering the preamp. Happy experimenting on 23 cm. ■

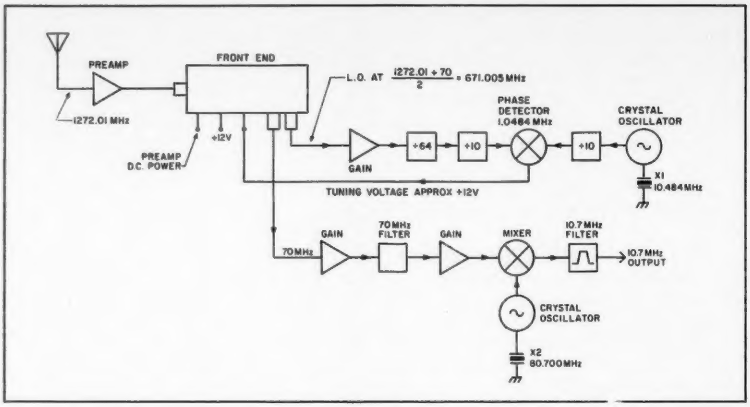

PREAMP
FRONT END
1272.01 MHz
L.O. AT $\frac{1272.01 + 70}{2}$ = 671.005 MHz
PHASE DETECTOR 1.0484 MHz
CRYSTAL OSCILLATOR
+12V
PREAMP D.C. POWER
GAIN
÷64
÷10
÷10
X1 10.484 MHz
TUNING VOLTAGE APPROX +12V
70 MHz
GAIN
70 MHz FILTER
GAIN
MIXER
10.7 MHz FILTER
10.7 MHz OUTPUT
CRYSTAL OSCILLATOR
X2 80.700 MHz

Fig. 9. Example shows 1272.01-MHz FM repeater input

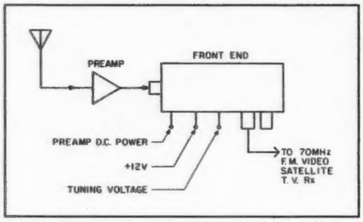

PREAMP
FRONT END
PREAMP D.C. POWER
+12V
TUNING VOLTAGE
TO 70 MHz F.M. VIDEO SATELLITE T.V. Rx

Fig. 10.

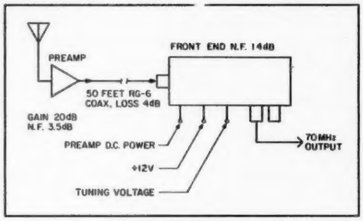

PREAMP
FRONT END N.F. 14dB
50 FEET RG-6 COAX, LOSS 4dB
GAIN 20dB N.F. 3.5dB
PREAMP D.C. POWER
+12V
TUNING VOLTAGE
70 MHz OUTPUT

Fig. 11.

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ultrastar AT-286 —LOTS OF EXTRAS!
10 mHz MONO MONITOR & GRAPHICS CARD STANDARD! — $1145

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CIRCLE 247 ON READER SERVICE CARD

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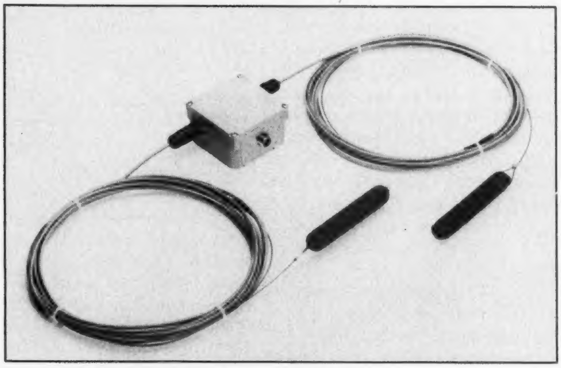


Wide Band Antenna

WIDE BAND ANTENNAS

A family of wide band antennas for high fractional band-width low HF bands eliminate the need for antenna tuners and special radiator networks.

Snyder Full-Band™ wide band antennas for the 160, 75/80, and 40 meter bands are designed to allow maximum use of modern broad frequency range, continuous or digital tuned transceivers and no-tune power amps to 1000 Watts. The antennas are redesigned and improved versions of wide-band dipole models previously marketed by Snyder.

The Snyder model FB-160X is $343, model FB-75/80 is $229 and model FB-40X is $179. They are complete with all needed parts plus detailed instructions for installation in flat-top or inverted vee configurations—plus technical application information on tuning each specific site for maximum effectiveness.

For additional information, contact *Poyntek Associates P.O. Box 741, Placentia CA 92670 (714/993-7527)* or circle Reader Service Card number 201.

CHIP RESISTOR AND CAPACITOR KITS

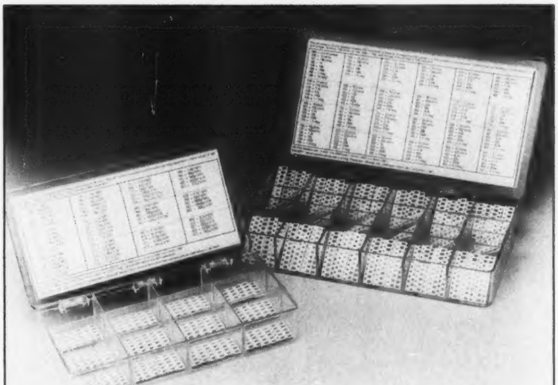
Communication Specialists in Orange CA has introduced the first complete chip resistor and capacitor kits. The kits may be used as parts kits for repair technicians and experimenters to eliminate the problems associated with prototyping, repairing, or experimenting with circuits that require the use of chip components.

The Chip Resistor Kit CR-1 contains 1540 pieces composed of: 10 chip resistors of every 5% value from 10 Ohms to 10 meg (145 values + 0 Ohm jumper), plus a bonus of 10 additional resistors in the 8 values of 0 Ohm, 10 Ohm, 100 Ohm, 1k, 10k, 100k, 1 meg, and 10 meg. Resistors are .10w 0805 size to 3.3meg, and .125w 1206 size above 3.3meg. Tolerance for all is 5% and each resistor is marked with 3 digit value.

The Chip Capacitor Kit CC-1 contains 365 pieces composed of: 5 chip capacitors of EVERY 10% value for 1pF, 10pF, 100pF, 1000pF, .01uF, and .1uF. Size is 0805 to .039uF, and 1206 above .039uF. Capacitors are NPO±10% to 680pF, X7R±10% 680pF to .1uF, and Z5U±20% above .1uF.

Each kit sells for $50 and both are available for immediate 1-day delivery from stock. A free brochure completely describing both kits is available.

For more information, contact *Communications Specialists, Inc., 426 West Taft Avenue, Orange CA 92665 (800/854-0547)* or circle Reader Service Card number 209.

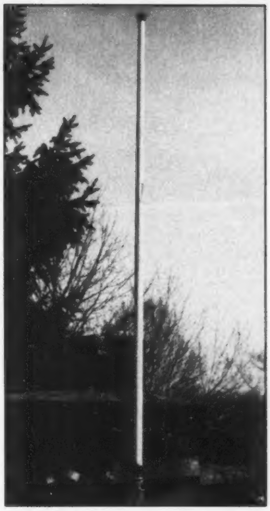


Chip Resistor & Capacitor Kits

TRI-BAND 2m/1.25/70CM SUBURBAN FIXED ANTENNAQC

Austin Suburban Antenna puts you on the three most active repeater bands with a single cable. It offers antenna functions as well as or better than a halfwave vertical on each band with low SWR and no radials. Just connect the PL-259 plug of your cable. It is a single 5-foot staff antenna with new internal technology. Cost is $70 and includes an aluminum mounting tube for U-bolt attachment to brackets or chimney strap.

For more information contact *Ed Noll W3FQJ, Book and Antenna Sales, PO Box 75, Chalfont PA 18914.* Or circle Reader Service Card number 205.

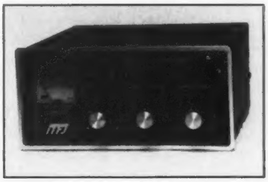


Tri-Band 2m/1.25/70 CM Fixed Antenna

MJF-931 ARTIFICIAL GROUND

MJF Enterprises announces the release of its MFJ-931. It creates artificial rf ground with random wire and electrically places far away ground directly at your rig.

The MFJ-931 connects between the ground connection of your transmitter or antenna tuner and the antenna. Two controls on the MFJ-931 are adjusted for maximum rf ground current using its built-in rf ammeter. This resonants the random wire, converts it into a tuned counterpoise and presents an effective low impedance near ground potential to your rig. Thus an artificial rf ground is created.



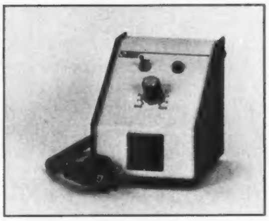
MJF-931 Artificial Ground

The MFJ-931 covers 1.8 to 30 MHz and is ruggedly built in an all aluminum cabinet with a brushed aluminum front panel. The retail price for the MFJ-931 is $80. It comes with a one year unconditional guarantee.

For additional information contact *MFJ Enterprises, Inc., at PO Box 494, Mississippi State MS 39762 (800/647-1800 or 601/323-5869)* or circle Reader Service Card number 207.

MODEL S-4 CONTROL UNIT

For your soldering projects, Sibex announces the release of the Model S-4 control unit. This product is designed to convert any soldering iron into an adjustable



Model S-4 Control Unit

Auto-Kall AK-10

temperature soldering station. The unit works with any 110 v AC powered iron up to 100 Watts in size.

Solid state circuitry is utilized to produce a spike free, adjustable dc voltage and minimizes the possibility of damaging critical components.

The Model S-4 offers a low-cost alternative for a temperature adjustable soldering station. The cost of soldering iron and tip replacement is minimized since the operator is not locked into a particular brand of iron for replacement.

Units are available from stock priced at $49.

For more information, contact *Sibex Inc., 1088 Kapp Drive, Clearwater FL 33575 (813/441-8525)* or circle Reader Service Card number 210.

MODEL 70-253

A new 16-channel programmable frequency-synthesized UHF portable two-way radio has been introduced by Midland Land Mobile Radio. The Model 70-253 portable features a front-panel keypad, liquid crystal display and a rated RF power output of 5 Watts, keypad switchable to 1 Watt. The new portables are currently FCC accepted for the frequency range 450-470 MHz.

Tone-coded squelch (CTCSS) is standard and each channel is separately programmable for any EIA tone. A DTMF option is also available. The programmable channel scanning option provides three scan modes: carrier, CTCSS or open-channel. The new portables use an E_2PROM-controlled microprocessor which permits any of the programmable functions to be quickly reprogrammed by an authorized technician equipped with a special programming unit.

Accessories include an external speaker/microphone. Three interchangeable battery options are available: 600 mAh and 1000 mAh rechargeable nickel-cadmium battery packs and a case for expendable batteries. With the 1000 mAh battery pack the Midland 16-channel UHF portable will provide 8 hours of operation at 5 Watts with a 5-5-90 duty cycle.

Equipped with the 1000 mAh battery pack, the new 16-channel portables are approximately 23.6 oz (0.67 kg). With the 600 mAh battery pack, the approximate height is 7.1" (183 mm) and weight is 21.1 oz (0.60 kg).

For more information, contact *Midland LMR, Marketing Department, 1690 N. Topping , Kansas City MO 64120 (800/643-5263)* or circle number 212 on your Reader Sevice Card.

Midland LMR 70-253 UHF portable

NEWS FROM MOTRON AUTO KALL AK-10

The Auto-Kall model AK-10 is a complete 3-digit DTMF touchtone™ selective calling system. Auto-Kall serves those who want to remain available and do not want to constantly monitor a busy repeater or simplex frequency. With the Auto-Kall you can get through to home when you are mobile or vice-versa. Set it to decode 911 and monitor the emergency phone calls on an autopatch repeater. DXers can let each other know when that rare one on their DX wanted list shows up.

The AK-10 can be used on any FM or AM receiver, transceiver, or scanner, and connects to the external speaker or earphone jack of your rig. Easy to operate, the personal code is set or changed in seconds with three small 16-position rotary switches.

The AK-10 includes a full 90-day warranty and the $90 price includes the AC power supply and audio patch-cord.

For more information, please circle Reader Service number 202.

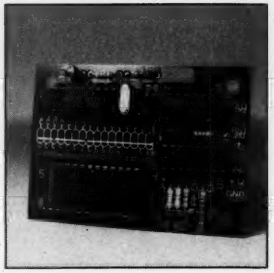
AUTO-CALL AK-4

The DTMF selective calling/control unit is suited for personal calls, group calls, control outputs and has unique control-up/control-down codes with adjustable time relay output.

Adjustable timed relay activates when code is received. When personal call code is received the relay can be used to turn on a speaker in order to hear an incoming call. Up to 16 different group call codes can be programmed into the AK-4. The onboard timed relay works with both the personal and group calling features. Group call LED latches on to alert you that a group call was received. Open collector transistor latched output is also provided to enable a remote buzzer, light, or horn.

As a remote controller, the AK-4 can be programmed to be enabled and disabled with different first digits in the code. That way you are always sure if you are turning it on or off. The AK-4 has two independently setable, resetable latched outputs plus two open collector momentary outputs that are active as long as the programmed key is held down.

The AK-4 is available as a Printed Circuit Board kit or as a wired and tested circuit board. All calling and command codes are user programmable with jumpers and diodes. The AK-4 will work with any FM or AM transceiver, scanner, or receiver, including CB AM. It will not work with SSB. For SSB/CW the Motron HF-ALERT will soon be available.



Net Kall NK-1

The price for a wired and tested PCB (user programmed) is $90. For the individual PCB kits the price is $70 ($58 in quantities of 10 or more) and for the AK-4H hardware kit, $30. The AK-4H hardware kit includes enclosure, speaker, spacers, switches, jacks and LED holders.

For more information contact *MoTron Electronics, 695 W. 21st Ave., Eugene OR 97405 (503/687-2118)* or circle Reader Service Card number 203.

NET-KALL NK-1

The Net-Kall NK-1 is a DTMF decoder. Each NK-1 can respond to any or all 16 group call codes so you can program one code to bring up all units in your system.

The NK-1 uses a single digit, user adjustable, with a trim-pot. When the NK-1 is triggered, the output goes active for the same length of time used to trigger it. The output will be retriggered if the key remains down. By removing a jumper, the output will latch on and stay on until manually reset.

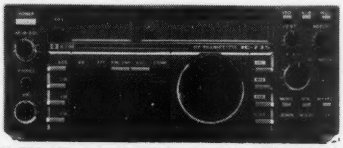
The NK-1 PCB kit consists of a circuit board (double sided, plated through, solder masked, silkscreened parts locations), all IC's including the SSI-202 DTMF decoder, IC sockets, resistors, capacitors, diodes, transistors and crystal.

The price for the NK-1W wired/tested PCB is $50. The NK-1K PCB kit is $40 and the NK-1B Bare Board with installation schematic is $20.

For more information, please contact *Motron Electronics, 695 W. 21st Ave., Eugene OR 97405 (503/687-2118)* or circle Reader Service Card number 204.

HF Equipment	**Regular**	**SALE**
IC-761 HF xcvr/SW rcvr/ps/AT	2499.00	**2149**
SP-20 Ext. speaker w/audio filter	149.00	**134^{95}**
FL-101 250 Hz CW filter	69.95	
FL-102 6 kHz AM filter	56.00	
CI-V Computer interface adapter	TBA	
EX-310 Voice synthesizer	46.00	

IC-751A 9-band xcvr/.1-30 MHz rcvr	1649.00	**1399**
PS-35 Internal power supply	199.00	**179^{95}**
FL-32 500 Hz CW filter (1st IF)	66.50	
FL-63 250 Hz CW filter (1st IF)	54.50	
FL-52A 500 Hz CW filter (2nd IF)	108.00	**99^{95}**
FL-53A 250 Hz CW filter (2nd IF)	108.00	**99^{95}**
FL-33 AM filter	35.25	
FL-70 2.8 kHz wide SSB filter	52.00	
RC-10 External frequency controller	39.25	
IC-745 9-band xcvr w/.1-30 MHz rcvr	1049.00	**899^{95}**
PS-35 Internal power supply	199.00	**179^{95}**
EX-241 Marker unit	22.50	
EX-242 FM unit	44.00	
EX-243 Electronic keyer unit	56.00	
FL-45 500 Hz CW filter (1st IF)	66.50	
FL-54 270 Hz CW filter (1st IF)	53.00	
FL-52A 500 Hz CW filter (2nd IF)	108.00	**99^{95}**
FL-53A 250 Hz CW filter (2nd IF)	108.00	**99^{95}**
FL-44A SSB filter (2nd IF)	178.00	**159^{95}**



IC-735 HF transceiver/SW rcvr/mic	999.00	**799^{95}**
PS-55 External power supply	199.00	**179^{95}**
AT-150 Automatic antenna tuner	445.00	**349^{95}**
FL-32 500 Hz CW filter	66.50	
EX-243 Electronic keyer unit	56.00	
UT-30 Tone encoder	17.50	

Other Accessories	**Regular**	**SALE**
IC-2KL 160-15m solid state amp w/ps	1999.00	**1699**
PS-15 20A external power supply	169.00	**154^{95}**
PS-30 Systems p/s w/cord, 6-pin plug	299.00	**269^{95}**
MB Mobile mount, 735/745/751A	24.50	
SP-3 External speaker	61.00	
SP-7 Small external speaker	49.00	
CR-64 High stab. ref. xtal (745/751)	63.00	
PP-1 Speaker/patch	159.25	**149^{95}**
SM-6 Desk microphone	44.95	
SM-8 Desk mic - two cables, Scan	78.50	
SM-10 Compressor/graph EQ, 8 pin mic	136.25	**124^{95}**
AT-100 100W 8-band auto. antenna tuner	445.00	**389^{95}**
AT-500 500W 9-band auto. antenna tuner	559.00	**489^{95}**
AH-2 8-band tuner w/mount & whip	625.00	**549^{95}**
AH-2A Antenna tuner system, only	495.00	**429^{95}**

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Other Accessories - continued:	**Regular**	**SALE**
GC-5 World clock	91.95	**89^{95}**

VHF/UHF base multi-modes	**Regular**	**SALE**
IC-271A* 25W 2 meters ... **CLOSEOUT**	859.00	**699^{95}**
AG-20* Internal preamplifier	64.00	
IC-275A 25W 2m FM/SSB/CW w/ps	1199.00	**1049**
IC-275H 100W 2m FM/SSB/CW	1389.00	**1229**
IC-475A 25W 440 FM/SSB/CW w/ps	1399.00	**1249**

IC-471A* 25W 430-450.... **CLOSEOUT**	979.00	**769^{95}**
AG-1* Mast mounted preamplifier	99.50	
IC-471H* 75W 430-450 ... **CLOSEOUT**	1399.00	**999^{95}**
AG-35* Mast mounted preamplifier	95.00	

***Preamp $9^{95} with 271A/471A/471H Purchase**

Accessories common to 271A/H and 471A/H		
PS-25 Internal power supply for (A)	115.00	**104^{95}**
PS-35 Internal power supply for (H)	199.00	**179^{95}**
SM-6 Desk microphone	44.95	
EX-310 Voice synthesizer	46.00	
TS-32 CommSpec encode/decoder	59.95	
UT-15 Encoder/decoder interface	14.00	
UT-15S UT-15S w/TS-32 installed	92.00	

VHF/UHF mobile multi-modes	**Regular**	**SALE**
IC-290H 25W 2m SSB/FM **CLOSEOUT**	639.00	**569^{95}**
IC-490A 10W 430-440..... **CLOSEOUT**	699.00	**499^{95}**

VHF/UHF/1.2 GHz FM	**Regular**	**SALE**
IC-27A Compact 25W 2m FM w/TTP mic	429.00	**369^{95}**
IC-27H Compact 45W 2m FM w/TTP mic	459.00	**399^{95}**
IC-37A Compact 25W 220 FM, TTP mic	499.00	**439^{95}**
IC-47A Compact 25W 440 FM, TTP mic	549.00	**479^{95}**
PS-45 Compact 8A power supply	139.00	**129^{95}**
UT-16/EX-388 Voice synthesizer	34.99	
SP-10 Slim-line external speaker	35.99	
IC-28A 25W 2m FM, TTP mic	459.00	**399^{95}**
IC-28H 45W 2m FM, TTP mic	489.00	**429^{95}**
IC-38A 25W 220 FM, TTP mic	489.00	**429^{95}**
IC-48A 25W 440-450 FM, TTP mic	489.00	**429^{95}**
HM-14 TTP microphone	55.50	
UT-28 Digital code squelch	37.50	
UT-29 Tone squelch decoder	43.00	
HM-16 Speaker/microphone	34.00	
IC-900 Transceiver controller	589.00	**529^{95}**
UX-29A 2m 25W unit	295.00	**269^{95}**
IC-3200A 25W 2m/440 FM w/TTP	599.00	**529^{95}**
UT-23 Voice synthesizer	34.99	
AH-32 2m/440 Dual Band antenna	37.00	
AHB-32 Trunk-lip mount	34.00	
Larsen PO-K Roof mount	20.00	
Larsen PO-TLM Trunk-lip mount	20.18	
Larsen PO-MM Magnetic mount	19.63	
RP-3010 440 MHz, 10W FM, xtal cont.	1229.00	**1089**
IC-1200A 10W 1.2 GHz FM Mobile	699.00	**629^{95}**
IC-1271A 10W 1.2 GHz SSB/CW Base	1229.00	**1069**
AG-1200 Mast mounted preamplifier	105.00	
PS-25 Internal power supply	115.00	**104^{95}**
EX-310 Voice synthesizer	46.00	
TV-1200 ATV interface unit	129.00	**119^{95}**
UT-15S CTCSS encoder/decoder	92.00	
RP-1210 1.2 GHz, 10W FM, 99 ch. synth	1479.00	**1289**

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Hand-helds	**Regular**	**SALE**
IC-2A 2-meters	279.00	**249^{95}**
IC-2AT with TTP	299.00	**259^{95}**
IC-3AT 220 MHz, TTP	339.00	**299^{95}**
IC-4AT 440 MHz, TTP	339.00	**299^{95}**
IC-02AT 2-meters	365.00	**299^{95}**
IC-02AT/High Power	399.00	**339^{95}**
IC-03AT for 220 MHz	449.00	**399^{95}**
IC-04AT for 440 MHz	449.00	**389^{95}**
IC-u2A 2-meters	299.00	**269^{95}**
IC-u2AT with TTP	329.00	**289^{95}**
IC-u4AT 440 MHz, TTP	369.00	**329^{95}**

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IC-12AT 1W 1.2GHz FM HT/batt/cgr/TTP	459.00	**399^{95}**
A-2 5W PEP synth. aircraft HT	499.00	**449^{95}**
A-20 Synth. aircraft HT w/VOR	599.00	**529^{95}**

Accessories for all except micros	**Regular**
BP-7 425mah/13.2V Nicad Pak - use BC-35	74.25
BP-8 800mah/8.4V Nicad Pak - use BC-35	74.25
BC-35 Drop in desk charger for all batteries	74.50
BC-16U Wall charger for BP7/BP8	20.25
LC-11 Vinyl case for Dlx using BP-3	20.50
LC-14 Vinyl case for Dlx using BP-7/8	20.50
LC-02AT Leather case for Dlx models w/BP-7/8	54.50

Accessories for IC and IC-O series	**Regular**
BP-2 425mah/7.2V Nicad Pak - use BC35	47.00
BP-3 Extra Std. 250 mah/8.4V Nicad Pak	37.50
BP-4 Alkaline battery case	15.25
BP-5 425mah/10.8V Nicad Pak - use BC35	58.50
CA-5 5/8-wave telescoping 2m antenna	18.95
FA-2 Extra 2m flexible antenna	11.50
CP-1 Cig. lighter plug/cord for BP3 or Dlx	13.00
CP-10 Battery separation cable w/clip	22.50
DC-1 DC operation pak for standard models	23.25
MB-16D Mobile mtg. bkt for all HTs	24.50
LC-2AT Leather case for standard models	54.50
RB-1 Vinyl waterproof radio bag	34.95
HH-SS Handheld shoulder strap	16.95
HM-9 Speaker microphone	47.00
HS-10 Boom microphone/headset	23.25
HS-10SA Vox unit for HS-10 & Deluxe only	23.25
HS-10SB PTT unit for HS-10	23.25
ML-1 2m 2.3w in/10w out amplifier ..... **SALE**	**99.95**
SS-32M Commspec 32-tone encoder	29.95

Receivers	**Regular**	**SALE**
R-71A 100 kHz-30 MHz, 117V AC	$949.00	**799^{95}**
RC-11 Infrared remote controller	67.25	
FL-32 500 Hz CW filter	66.50	
FL-63 250 Hz CW filter (1st IF)	54.50	
FL-44A SSB filter (2nd IF)	178.00	**159^{95}**
EX-257 FM unit	42.50	
EX-310 Voice synthesizer	46.00	
CR-64 High stability oscillator xtal	63.00	
SP-3 External speaker	61.00	
CK-70 (EX-299) 12V DC option	12.25	
MB-12 Mobile mount	24.50	
R-7000 25 MHz-2 GHz rcvr.. **SPECIAL**	1099.00	**899^{95}**
RC-12 Infrared remote controller	67.25	
EX-310 Voice synthesizer	46.00	
TV-R7000 ATV unit	131.95	**119^{95}**
AH-7000 Radiating antenna	89.95	

(4)

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800–900 MHz The Easy Way

Put a UHF TV tuner in line between a scanner and a suitable antenna, and voila! You are now scanning this very active public-service spectrum.

Have you had an itch to listen in on 800–900 MHz activity? It's really very easy if you have an available UHF TV tuner and a synthesized scanner receiver. The scanner provides the i-f, detector, and search receiver. As far as the scanner knows, it is listening to 45 MHz, but in reality, it is listening to 800 MHz through a converter. TV tuners have been engineered well and provide fair sensitivity at 800 MHz. A low-noise GaAsFET rf stage ahead of the tuner enhances its operation. In large cities, however, the barefoot TV tuner gives very good results.

Attach an antenna and power supply to the tuner. Then connect the i-f output from the tuner to the coaxial antenna input of the scanner (Figure 1) and set up a frequency search from 44–46 MHz. The 800-MHz monitor is now ready to go.

Momentarily stop the search at about 45 MHz, and then slowly adjust the tuner from channel 79 through 83. Stop adjusting anytime a signal is detected, even if you went past the detected signal slightly. Do *not* reverse the tuning knob at that point, as tuner shaft backlash may cause the tuner to make a large jump in frequency passing over the previously detected signal.

Release the search and the receiver will now tune across a 2-MHz segment of the band. It will lock on any signal that is strong enough to open the squelch. If a given scanner has an oscillator birdie within the 2-MHz segment, shift the 2-MHz segment to one side or the other to avoid the birdie. TV tuners are fairly broad-banded and will usually respond over the i-f frequency range from 42–48 MHz. Some sensitivity loss may be experienced in the outer frequency limits, but this will probably not be noticed since the scanner gain makes up for this. Repeat the tuning and scanning procedure until a desired segment of the band is located.

Setting Up the Tuner

UHF TV tuners use a vfo oscillator which is sensitive to supply voltage changes. Small voltage changes will cause the oscillator to drift or wobble in frequency. If used outside the TV set, a voltage-regulated power supply must be used for power to maintain tuner oscillator stability. The circuit in Figure 2 provides up to 60 mA for 2–18 volts, which is suitable for powering most solid-state tuners.

Determine the power supply voltage before connecting power. With the pot adjusted for the lowest output, turn on the supply and raise the voltage to the desired value. *Do not exceed the rated voltage for the tuner.*. You can also determine the tuner voltage by adjusting the power supply voltage while monitoring the relative signal strength from the station for background quieting (squelch open), but this is risky. Some tuning adjustment may be necessary as the supply voltage is raised.

The voltage to the tuner shouldn't be any higher than necessary for reliable tuner operation. For most tuners, this will be below 20 volts for a full-quieting signal. The idea is to keep the transistor heat dissipation low to minimize thermal drift. Some varactor tuners need only nine volts for operation. Tube-type tuners also work well in the 800–900 MHz range.

Examine the tuner output circuit before connecting it to the scanner. Some tuners require a dc load to ground; others, like the tube-types, need B+ for the mixer plate. A 1-k resistor from the tuner output to ground will suffice for the solid-state type using a diode mixer. Direct coupling to the coax input of the scanner is normal as long as no dc supply is required for the tuner through the i-f connector.

Determining the specific frequency being monitored is very difficult using the technique described above. Calibration can be achieved only by listening to a signal of known frequency. Most UHF TV tuners use high-side oscillator injection. Injecting high or low has no effect on the quality of the received signal. When there is high-side injection, however, with the scanner searching up in frequency, the 800-MHz band will be searched downward.

Power Supply

The power supply shown in Figure 2 is assembled around the popular 723 voltage regulator IC, available at most electronic outlets. Although the IC is capable of handling up to 150 mA, a 2N2222 (2N4401 or equivalent) pass transistor is used to increase the

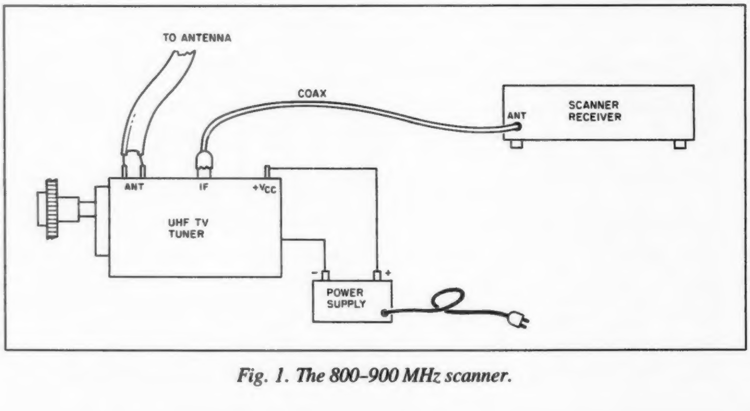

Fig. 1. The 800–900 MHz scanner.

loop gain for better regulation. Singletransistor UHF TV tuners typically draw 20 mA at about 18 V, which is well under the capacity of the pass transistor. Avoid using larger higher-current pass transistors to keep the ripple pass-through to a minimum. Larger transistors also require higher load currents. The power supply is protected from accidental output shorts by a series-current sensing resistor (R3) which limits the current to a maximum value. The resistor value for current limiting is calculated by dividing 0.66 V by the maximum desired output-limiting current. 50-60 mA is a suitable current limiting value for most tuner applications.

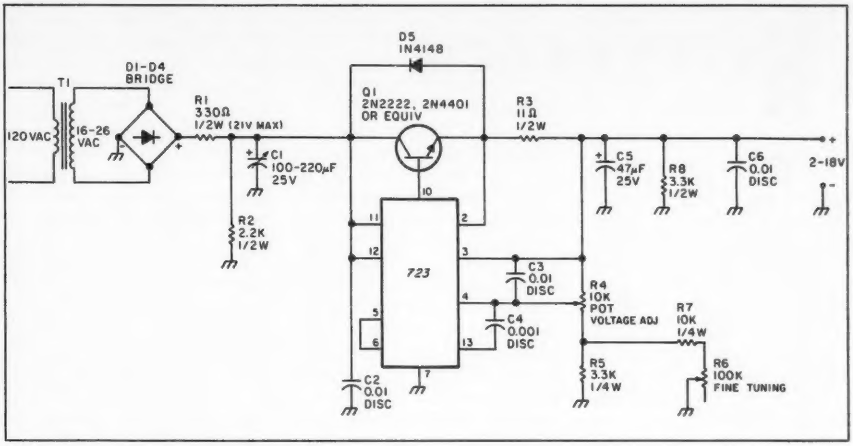
T1
120VAC
16-26 VAC
D1-D4 BRIDGE
R1 330Ω 1/2W (21V MAX)
C1 100-220µF 25V
R2 2.2K 1/2W
D5 1N4148
Q1 2N2222, 2N4401 OR EQUIV
R3 11Ω 1/2W
C5 47µF 25V
R8 3.3K 1/2W
C6 0.01 DISC
+
2-18V
-
723
10
11
12
2
3
4
5
6
13
7
C3 0.01 DISC
C4 0.001 DISC
R4 10K POT VOLTAGE ADJ
R7 10K 1/4W
R5 3.3K 1/4W
R6 100K FINE TUNING
C2 0.01 DISC

Fig. 2. Tuner power supply.

Potentiometer R6 may be added as a fine-tune. Small supply voltage variance causes a frequency shift of about 25 kHz. Some TV tuners respond more than others to the voltage change; fine-tuning capability must be determined experimentally on each tuner. Set the pot to 3/4 of maximum resistance, and vary for frequency control.

Examine the tuner output circuit before connecting it to the scanner.

Selection of a power transformer is probably the most difficult task of all. Any transformer capable of delivering 16–18 V at 100 mA will work well. A 6.3-V transformer at 300 mA followed by a voltage tripler (Figure 3) provides about 21 Vdc to the regulator. Assuming 3 V of regulator headroom, the maximum regulated output would be about 18 V, providing an ample voltage range.

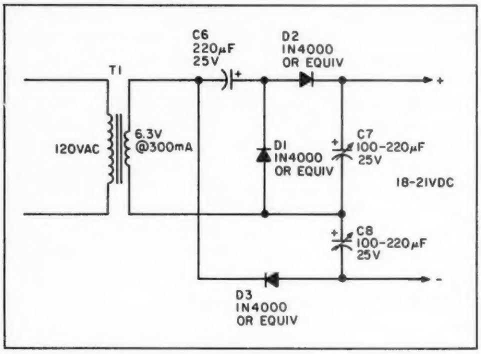
T1
120VAC
6.3V @300mA
C6 220µF 25V
D2 1N4000 OR EQUIV
+
D1 1N4000 OR EQUIV
C7 100-220µF 25V
18-21VDC
C8 100-220µF 25V
D3 1N4000 OR EQUIV
-

Fig. 3. Voltage tripler.

Higher regulator input voltages should be carefully considered for circuit reliability. As a rule of thumb, the voltage input to the regulator should not be more than 7 V above the regulated output to keep the pass transistor heat dissipation to a satisfactory level. Resistors R1 and R2 are used to reduce the rectified output voltage to ensure a 21-V input voltage to the regulator.

Antennas

A wide variety of antennas is available for the 800-MHz band. Selecting one over another is a matter of choice determined by the signal strength from the monitored station. Even a typical UHF TV loop antenna works well for local stations, but an outside UHF TV antenna works much better since most UHF TV tuners lack an rf stage. Some readily available TV baluns (matching transformer) will work up to a gigahertz, allowing coax to be used as a feedline. Coax lengths should be kept short at 800 MHz, however, as the loss due to attenuation is quite severe.

A suitable antenna for 800 MHz which has been used successfully with TV tuners is a ground-plane antenna assembled on the top of a balun, as shown in Figure 3. The elements are cut to 3-3/8 inches long and allowed to droop about 60 to 80 degrees from the horizontal. TV twinlead is used as feedline from the antenna to the tuner. Signal attenuation along twinlead at 800 MHz is acceptable for reasonably short lead lengths. Also, the TV tuner appears to be tolerant of the transmission line discontinuities caused by the feedline lying against objects along its path.

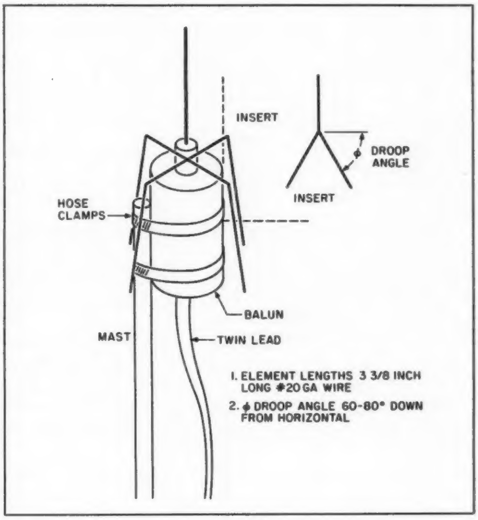
INSERT
DROOP ANGLE
INSERT
HOSE CLAMPS
BALUN
MAST
TWIN LEAD
1. ELEMENT LENGTHS 3 3/8 INCH LONG #20GA WIRE
2. ϕ DROOP ANGLE 60-80° DOWN FROM HORIZONTAL

Fig. 4. Ground-plane antenna.

Obviously, the antenna and feedline are not suitable for transmitting. For an outdoor antenna, use silicon rubber material to seal the balun and antenna connections exposed to the weather. Sealant material should be used sparingly, especially where it bridges the vertical element and ground. It seems that some solvents used are conductive at 800 MHz until completely evaporated.

Join the 800–900-MHz scanner crowd the easy way by using a UHF TV tuner as a converter ahead of a scanning receiver. Follow the instructions provided in the article for a simple and easy way of listening on this band. ■

NEVER SAY DIE

from page 4

right on down to Virginia or out to Ohio. I used to take my HT with me on commercial airline flights and get permission from the captain to operate—working through repeaters all across the country from 35,000 feet. That was fun! There are too many repeaters for that these days.

When slow scan came along I set up one camera on a menu board, another on me at the operating table and a third on a slide viewer so I could show slides of my shack, the house, my wife and kid—stuff like that. It was a blast. I'd call CQ and QSL my contacts with the menu board. The main problem was coming up with new things to send—programming. No one wanted to see my same slides over again, so I found myself spending a lot of time and work on programming.

Working the pileups from a rare location is fun—a lot of fun. Oh, it can be frustrating too. Going on a DXpedition has got to be one of the most fun things hamming has to offer. I've been to Navassa twice—1958 and 1973. Both trips were unforgettable.

In 1966 I made a trip around the world. I operated from Kenya, Lebanon, Syria, Iran, Afghanistan, India, Nepal, Singapore, Australia, New Caledonia, Fiji, Western Samoa, American Samoa and Tahiti. Since I visited hams in most countries the trip was amazingly inexpensive... and, boy, was it fun. I ran across a day by day account of the trip recently—most of it never published. You might enjoy reading about it... let me know.

Back when I was in college I had a 75m AM kilowatt plus an all-band AM kilowatt I used mostly on 20m. I got settled in talking with the same bunch of hams every night on 75m—Homer W1KPL in Jaffrey NH, Bill and Olga W1IF in Peabody MA and Leo W1MLJ in Barre VT. I'd occasionally go down on 20m and relay a DX station into our 75m roundtable—making it more exciting.

The early days of RTTY were a ball. I started with a Model 12—a real old-timer which kicked up all sorts of noise as its magnets clanked. We were on 147.96 MHz with fairly wide band receivers—the old SCR-522 rigs. We used an 8220 kHz surplus crystal and that, with two triplers and a doubler, put us on channel. Our stuff was all homemade and we didn't chintz either. Our converter panels were packed with tubes which generated the 2125 and 2975 Hz tones—plus superb filters made from old output transformers—auto-start and auto-stop circuits—a clock to turn on the receiver every hour to check for traffic—auto-acknowledge the receipt of messages during unattended operation—and so on. I could set the clock on my panel to check for traffic on the hour or switch it to check at some special minute designated for messages just for my station.

In those days we weren't permitted FSK on the lower bands so I experimented with make-break RTTY keying on 80m—and worked around the country with it. Up on 11m there were no restrictions, so we worked some nice DX there.

> ***"Working the pileups from a rare location is fun—a lot of fun. Oh, it can be frustrating too."***

I helped W2BFD set up one of the first repeaters on 2m almost 40 years ago! We set this up in the Municipal Building in New York and it made it possible for all of the RTTY nuts in the greater New York area to work everyone else for the first time. Yes, we had fun.

So, how about it—what have you done in amateur radio that was really fun? I'd love to get some letters I could print in 73. We might even give some of the readers ideas.

One day in 1947, five of us from my college radio club piled into my old '40 Ford and drove to the top of Mt. Greylock. I had along my SCR-522 (BC-624 and BC-625) and the 16-element beam. We had a ball working all around New England and down to New York and Long Island.

It was exciting in 1948 when I operated for several months from the top of the *Daily News* skyscraper on 42nd Street in New York—again with my old 16-element Bill Hoisington beam and my 522 rig. I was working for WPIX, the News TV station, as an engineer, so getting a spot for my hamshack on the 29th floor was easy.

I also enjoyed working 2m from the top floor of the Guggenheim Museum on Fifth Avenue, where I worked on a modern art color organ project on a Guggenheim grant in 1952.

How about the sweepstakes contest in 1951 when I operated the first weekend as W2NSD/8 in Cleveland and ran up a great score—then, the second weekend, I ran up another high score as W8NSD/2 from Brooklyn and the only equipment I used at both locations was my D104 mike.

I often remember the fun I had down in Sarasota FL where I was an announcer/engineer for WSPB and worked 6m skip all over the country as W4NSD.

So how about it—you must have had some exciting times with amateur radio. Unless you write about'em, they'll be lost.

No, I haven't come anywhere near exhausting my own treasury of priceless ham experiences. Like talking to my home station on both 20 and 75m from Birchip Australia while visiting moonbouncer VK3ATN and hearing my signal pour in S9+ on both bands! Like working home from YK1AA in Damascus. Like working seven states on 10.5 GHz recently. Like pioneering narrow band FM in 1946. Like working W7IMW/C7, who was running 10 watts from Tsiensin, China one morning on 20m. Like visiting Robby 5Z4ERR in Nairobi. Like flying around the world on Operation World Wide in 1959 with Bill Leonard W2SKE, visiting 24 countries, and hamming on SSB all the way from our plane. Like representing the US at the World ITU Conference in 1959. Like working cross-band through my repeaters on 10 and 20m. Like hearing me making a contact with a ham in Roumania on a record Hallicrafters used to promote their radios.

When I have fun at something I want to share it. I want to interest others so they can enjoy it too. In Digital Audio magazine I'm writing about the excitement of classical music and how to get started enjoying it, hoping to get more people interested—sharing my enjoyment. In 73 I've tried to share my enthusiasms down through the years. When FM and repeaters came along I pushed the heck out of 'em and helped get hams all over the world onto FM. When I got my first Porsche in 1957 I loved it and wrote about it. The Speedster was a blast and only cost $3,300 in those days.

When computers came along I tried 'em and had an exciting time. That not only got me going with computer articles in 73, but got me to start *Byte* and a bunch more computer magazines.

I enjoy travel so I write about it and even manage to lead tours. In 1963 I took 73 hams on a trip to London, Paris, Geneva, Rome and Berlin. We had an incredibly good time—with ham parties in most of the cities. Sadly, it was while we were on this tour that the League petitioned the FCC for what they called Incentive Licensing—the worst disaster in the history of our hobby, one which still haunts us. That's when we stopped growing. I wanted to lead more ham tours, but amateur radio was so badly wounded no more ham tours have been possible.

In the last few years I've been having a great time leading tours to Asia—I'm expecting nearly 500 this year to visit the consumer electronic shows in Osaka, Seoul, Taipei and Hong Kong. We usually have a dozen or two hams along.

I almost forgot the day I worked Moscow via Oscar—that really got me excited since there was only a 20-second window for the contact. And the time I was stranded on top of Mt. Washington when the cog railway broke and my Gonset was the only means of communications from the mountain top. I passed phone patch traffic to the families of those stranded with me... made the Boston papers. How about the 73 hamfest in Peterborough in 1965 when we pulled more hams than the ARRL National the same weekend! Fifty years of active hamming has brought me a lot of fun—fun I want to share with you. So I want to know about your fun—perhaps you can clue me in to some things I've missed—fun I can still have.

2300 MHz Secretly Sold?

A usually reliable source within the ARRL claims to have person-

Continued on page 62

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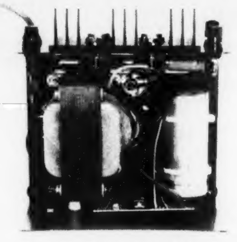
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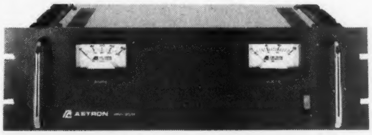
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19" × 5¼ RACK MOUNT POWER SUPPLIES

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RM-12A	9	12	5¼ × 19 × 8¼	16
RM-35A	25	35	5¼ × 19 × 12½	38
RM-50A	37	50	5¼ × 19 × 12½	50
• Separate Volt and Amp Meters				
RM-12M	9	12	5¼ × 19 × 8¼	16
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50

RS-A SERIES

MODEL RS-7A

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-3A	2.5	3	3 × 4¾ × 5¾	4
RS-4A	3	4	3¾ × 6½ × 9	5
RS-5A	4	5	3½ × 6⅛ × 7¼	7
RS-7A	5	7	3¾ × 6½ × 9	9
RS-7B	5	7	4 × 7½ × 10¾	10
RS-10A	7.5	10	4 × 7½ × 10¾	11
RS-12A	9	12	4½ × 8 × 9	13
RS-12B	9	12	4 × 7½ × 10¾	13
RS-20A	16	20	5 × 9 × 10½	18
RS-35A	25	35	5 × 11 × 11	27
RS-50A	37	50	6 × 13¾ × 11	46

RS-M SERIES

MODEL RS-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• Switchable volt and Amp meter				
RS-12M	9	12	4½ × 8 × 9	13
• Separate volt and Amp meters				
RS-20M	16	20	5 × 9 × 10½	18
RS-35M	25	35	5 × 11 × 11	27
RS-50M	37	50	6 × 13¾ × 11	46

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VS-12M	9	5	2	12	4½ × 8 × 9	13
VS-20M	16	9	4	20	5 × 9 × 10½	20
VS-35M	25	15	7	35	5 × 11 × 11	29
VS-50M	37	22	10	50	6 × 13¾ × 11	46
• Variable rack mount power supplies						
VRM-35M	25	15	7	35	5¼ × 19 × 12½	38
VRM-50M	37	22	10	50	5¼ × 19 × 12½	50

RS-S SERIES

MODEL RS-12S

- Built in speaker

MODEL	Continuous Duty (Amps)	ICS* Amps	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-7S	5	7	4 × 7½ × 10¾	10
RS-10S	7.5	10	4 × 7½ × 10¾	12
RS-12S	9	12	4½ × 8 × 9	13
RS-20S	16	20	5 × 9 × 10½	18

*ICS—Intermittent Communication Service (50% Duty Cycle 5min. on 5 min. off)

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Professional Troubleshooting Tricks

Troubleshooting electronic equipment is not simply probing around the circuit looking for a loose connection or a burned component. Nor is it random replacement of parts. Skillful troubleshooters use an arsenal of specialized test methods applied to certain strategic points in the circuit. These procedures are simple, quick, and efficient. Let's have a look at some of them.

Out-of-Circuit Tests

An easy way to make a rough check for leakage, shorts, and gain of a bipolar small-signal transistor is shown in Fig. 1. You simply connect the ohmmeter leads to the collector and emitter, observing the correct polarity. Set the meter on the 1K scale. If the transistor is an NPN, as shown, then the negative lead goes to the emitter. If it is a PNP, the leads will be reversed. In some meters the battery is connected so that the positive polarity is on the black or common lead. If in doubt, check the voltage at the ends of the ohmmeter leads with a separate voltmeter.

> ***"Skillful troubleshooters use an arsenal of specialized test methods applied to certain strategic points in the circuit."***

When the meter leads are connected properly to a good transistor, the meter will show high resistance with the base open. A resistance reading less than 10K indicates leakage, and such a transistor may even produce a short from collector to emitter when higher voltages are applied in the circuit.

Now make a connection through the resistance of your moistened fingers from the base to the collection while holding the probes on the collector and emitter (see Photo A). A good transistor will show a definite drop in resistance between the emitter and collector, proving that the base has control over the collector current. This test is used by many technicians because it is easy, requires no fancy equipment, and it tells you all you need to know to troubleshoot a suspected transistor.

Diodes can also be checked using the ohmmeter on the 1K scale. With the probes in one direction the resistance should be over 50K, and it should be less than 500 Ohms when the probes are reversed. A forward-to-reverse ratio of less than 100:1 indicates a leaky diode.

Incidentally, since the base-emitter junction is a diode, you can use the ohmmeter to

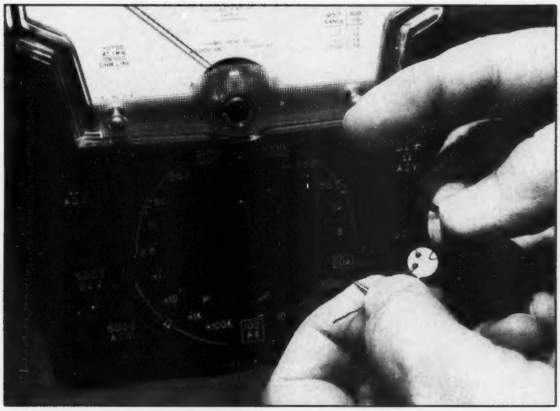

Photo A. The emitter lead and one ohmmeter probe are held in the left hand while the collector lead and the other probe are held between the thumb and third finger of the right hand. The resistance will drop when the moistened forefinger touches the base lead.

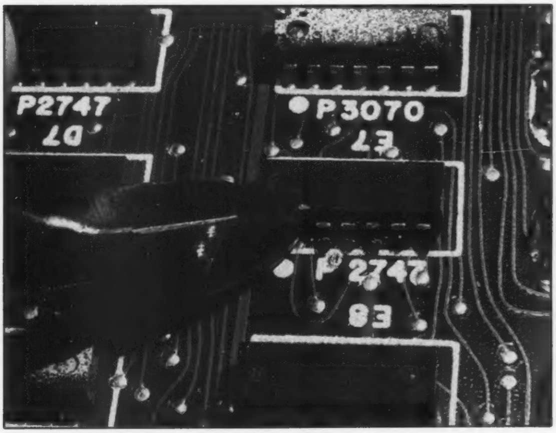

Photo B. An integrated circuit can be removed by cutting the pins close to the case. The stubs are then removed by gently heating from the bottom and pulling from the top.

help you figure out whether an unknown transistor is PNP or NPN and which leads are the base and emitter.

Note that these tests will not work on FETs because the resistance from source to drain cannot be changed unless reverse bias is applied between the gate and the source.

In-Circuit Tests

The above tests are used when the component is out of the circuit, but sometimes it is advantageous to make a quick test before removing the suspected component for further testing. The first step, if the power supply is working, is to check for overheated components. A hot transistor does not necessarily mean that it is defective but it indicates that something is wrong with this section of the circuit. An overheated resistor is usually caused by excessive current flowing in an associated part, not by the resistor itself.

The method illustrated in Figs. 2 and 3 seldom fails to find a bad transistor in a circuit where there are no other faulty parts. With the power supply connected, short the base to the emitter while measuring the collector voltage. I use a draftsman's dividers and press the points into the pads on the circuit board. With the base-emitter voltage thus reduced to zero, a good transistor will have no collector current, and its collector voltage will rise sharply.

Fig. 3 shows an alternative method whereby the base-emitter voltage is increased by connecting the base to the collector through a 10K resistor. In a good transistor this will increase the collector current flowing in the collector resistor, thus reducing the collector voltage measured to ground. If the decrease in collector voltage is very slight and you want further confirmation of the quality of the transistor, try a 4.7K resistor, but connect it very briefly.

In order for either of these tests to work well, the circuit must have at least a few thousand Ohms of resistance in the collector load—so they can't be used when the collector load is a transformer winding. However, in this case there is usually an emitter resistor and emitter voltage can be used as the indicator. There is just one complication: When shorting the base to emitter of a good transistor, the emitter voltage goes to zero instead of rising to the supply voltage as the collector voltage does. The results of the other test are also reversed. All the possibilities for each test on a bipolar transistor are summarized in Table 1.

If you short the gate to the source of a FET, the drain current will go up and the drain voltage will drop. Connecting the gate to the drain of a FET does not provide any useful information.

Tracing Toward the Power Supply

Fig. 4 illustrates a very useful technique for finding a shorted or open component. In this example, all test points are measured with a voltmeter connected between the test point and ground. The sequence of steps to locate the shorted capacitor might go like this: The technician first finds zero volts on the collector of the transistor. The next test is for emitter voltage at point 2, where he also finds zero.

The method explained in the previous section would not be used here since it is unlikely that a transistor failure could cause both voltages to be zero. It is apparent that the trouble lies closer to the power supply.

Test point 3 is checked next. If voltage were present here one would suspect an open on the circuit board foil leading to the collector. However, the voltage at this point is found to be zero also. Test 4 eliminates an open transformer winding as the cause of the missing collector voltage. If a voltage were found at test point 4, the technician would suspect the transformer and would check it with the ohmmeter. But in this case the voltage is still zero so the transformer is not suspected. When test point 5 is found to be zero, it is clear that the trouble is still closer to the power supply, so the meter probe is moved across the next component, R3. A voltage present at point 6 indicates that we have just crossed the defective part. Either R3 is open, causing zero volts at point 5, or the capacitor is shorted, grounding point 5.

You could check R3 by shorting across it, using the draftsman's dividers. If the resistor were open, a voltage would now be present at test point 5. The capacitor can be checked by snipping one lead and measuring the voltage at point 5. Often, when a part is shorted to ground, other parts in series will be damaged by the excessive current drawn through the shorted part. These associated parts need to be checked also. In this case, R1 and R3 should be examined for signs of overheating.

When the Audio Is Distorted

The problem of distorted audio is difficult because there are usually several stages in the audio section and any one of them could be at fault. It is not necessary to use a signal generator and oscilloscope to check each stage, although this might be fun to do if you have the time and equipment needed. But an easier way to locate the stage producing distortion is to make use of what is called the operating poin, or quiescent point of each stage.

The quiescent point, usually called the Q-point, is the dc voltage from collector to emitter of an amplifier when there is no signal present. Note that this voltage is not measured from collector to ground but from collector to emitter. When a signal passes through an amplifier this voltage varies up and down from the Q-point in accordance with the incoming signal waveform. But with no signal, the voltage rests at about 1/2 of the power supply. If this Q-point shifts from the midpoint between the power supply voltage and zero, then there will be less room for it to swing in one direction than in the other when a signal is applied. This results in a distorted output since the waveform will be clipped on the end where there is less room for the voltage to swing.

Thus a shift in the Q-point of an audio voltage amplifier is always

RESULTS FROM IN-CIRCUIT TEST OF BIPOLAR TRANSISTORS
shown in Figs. 2 and 3

BASE-EMITTER SHORTED	
GOOD TRANSISTOR	BAD TRANSISTOR
Collector Voltage rises Emitter Voltage drops	Collector Voltage unchanged Emitter Voltage present
COLLECTOR-BASE CONNECTED THRU 10K	
GOOD TRANSISTOR	BAD TRANSISTOR
Collector Voltage drops Emitter Voltage rises	Collector Voltage unchanged Emitter Voltage unchanged

Table 1.

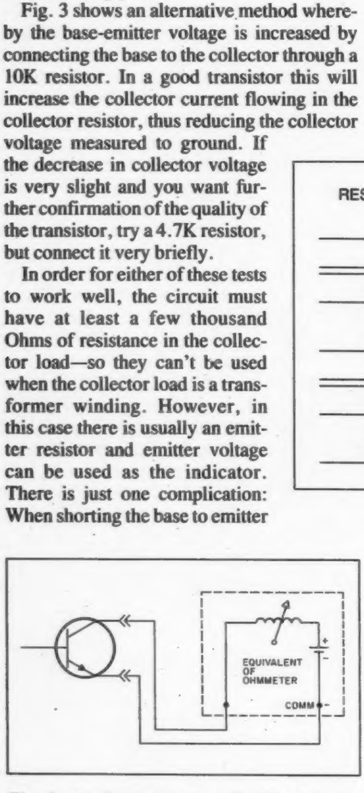

Fig. 1. An ohmmeter set on the 1K scale can be used to check transistors for leakage. Check the polarity of the voltage at the ends of the probes.

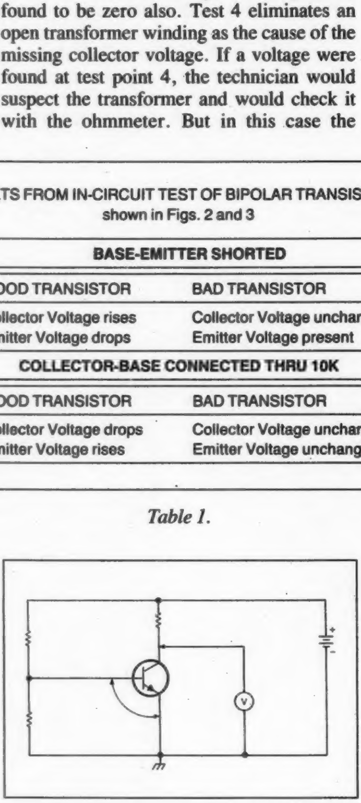

Fig. 2. If the transistor is good, the collector voltage will rise when the base is shorted to the emitter.

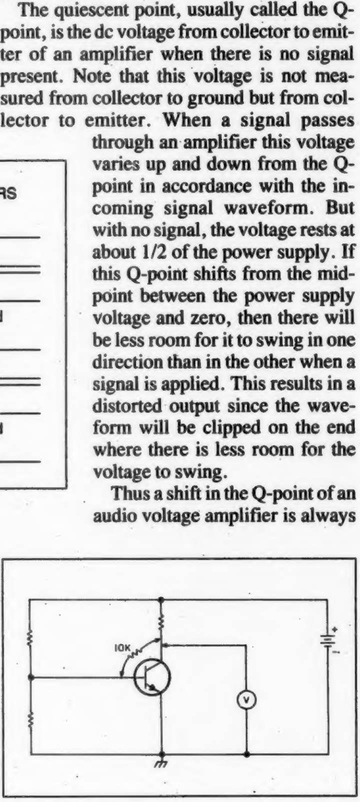

Fig. 3. If the transistor is good, the collector voltage will drop when the base is connected to the collector through a 10K resistor.

a clue that the amplifier is causing distortion. All the troubleshooter has to do to locate the faulty stage is measure the emitter-to-collector voltage of each stage. Some variations in the Q-point are normal and there is often a built-in shift of as much as 1.5 volts due to the voltage across the emitter resistor, but the stage causing objectionable distortion will show a large Q-point shift. The common causes for Q-point shift are shown in Fig. 5. They are:

- 1. The transistor characteristics have changed.
- 2. Leakage of C1.
- 3. Shorted C2.
- 4. R1, R2, R3, or R4 have changed value.

In this case, a faulty transistor might still respond correctly to the earlier tests described, so when there is distortion it is always a good idea to substitute a new transistor. But the other parts are easier to check, so they should be dealt with first. The condition of C2 can be determined simply by snipping one lead and listening to the amplifier. If C2 was shorted, the distortion will disappear, although the gain will be low without an emitter bypass capacitor. The four resistors are not likely to fail and need not be tested if they show no signs of overheating. If you decide to measure them, be sure to remove one resistor lead from the circuit board to avoid measuring other things which are in parallel.

C1 is a frequent cause of distortion when it leaks even slightly. An interesting way to check for this, if you have a vacuum-tube voltmeter or one with a FET in the input, is shown in Fig. 5. If possible, loosen the end of the capacitor which leads to the next stage and connect your voltmeter between this capacitor lead and ground. Now operate the amplifier with no signal applied. The slightest indication on the meter shows leakage.

When the amplifier has a push-pull output stage, these Q-points might be much higher and this does not indicate a failure. But the two Q-points must be equal if the stage is working properly.

Methods

Troubleshooting ICs requires that you know what the chip is supposed to be doing and what each lead is for. This means that you must have the specs for the IC. My favorite source for this information is the *ECG Replacement Guide*, published by Sylvania. Besides giving the numbers of replacement units for nearly all chips, it also provides the pin diagrams.

Most ICs fall into three basic categories:

- 1. Simple gates such as the AND, OR, NOR, and NAND gates. A chip may contain several gates of the same type. A certain combination of input pulses applied to the input of a gate may produce an output voltage, or may cause the output to drop to zero, depending on the type of gate.

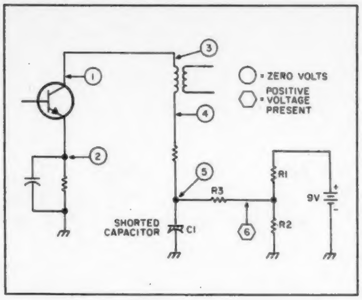

Fig. 4. The shorted capacitor, C1, is located by following this series of voltage checks.

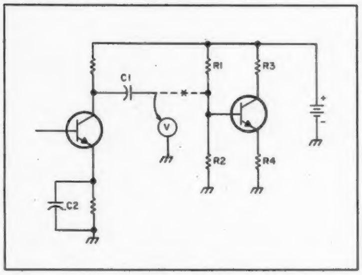

Fig. 5. Using a high impedance voltmeter to test for a leaky coupling capacitor.

- 2. Flip-flops that alternate the output voltage between two output pins every time the input is pulsed.
- 3. Op amps, containing one or more linear amplifiers that can be used in place of discrete amplifier circuits.

Obviously, you need more than the pin diagram to test these ICs. But one thing you can do, even if you have no information about the chip, is to test its operating temperature with your finger. A hot chip is probably a bad one. The only exceptions are the power amplifier type op amps and you recognize these by the heat sink.

Once you know the function of the chip and have the pin diagram in front of you, you can make a few simple tests. One method is to supply voltage so input can always be safely obtained by using a 1K resistor on the end of a wire leading back to the positive side of the power supply. Be sure you know what it takes to change the output: Sometimes you need to supply input to more than one pin at a time.

If the output does not change, don't jump to the conclusion that the gate is bad. Its output may be loaded down by the next gate to which it is connected; or the input may be loaded down by the output of the preceding gate. Keep checking until you can isolate which chip needs replacement. Sometimes it is necessary to cut the copper foil between the input and output of two chips to prevent the loading effect.

It is very unlikely that you will damage an IC if you accidentally short two or more pins together, despite what you may have heard. Certain high-frequency insulated-gate FETs can be damaged by soldering or handling the leads, but you would have to be persistent to do any harm.

A clue indicating a bad chip is the condition called a floater. This refers to the case where the output voltage seems to float around a value somewhat less than the full output voltage even when the input signal is present. Again, this may be caused by a defect in the chip or by loading from the next stage.

Op amps can be checked easily with the same 1K resistor leading back to the positive supply terminal. Op amps have two input terminals: A positive voltage applied to one will cause the output voltage to spring up to a value near the supply voltage; while input supplied to the other will cause the output to go down. So it is easy to find an op amp which is completely inoperative. The tough ones are the op amps which are only slightly defective and they still operate but not as they should. Op amps working as linear amplifiers should have a Q-point about 1/2 of the supply voltage as described previously. However, when a dual-power supply is used, the Q-point will be at ground potential.

Once you have found a faulty IC, removing it from the circuit board can be quite a challenge if it is soldered in. First, make a note or a sketch so you can remember which way the new IC goes in because it can be installed backwards. You can tell one end from the other by the shape of the case, or by a blob of paint, or a tiny indentation at one end. Two devices are commonly used to remove the solder from the pins. One is called a Solder Sucker. This will allow you to suck the molten solder from around the heated pin. The other is called Solder Wick, which is a strip of braided copper. You place the braid on the pin and heat the braid until it absorbs the molten solder.

The difficulty with both of these devices is that they may require too much heat for some circuit boards. They work well on the epoxy glass boards with reasonably thick copper pads, but when used on phenolic board with thin copper, the copper comes loose from the board if you're not careful. Photo B shows an expedient used by many technicians when they feel that the board might be ruined by trying to unsolder a chip. After the chip is removed by cutting off the pins from the top, the stubs can be removed by gently heating each one from the bottom while pulling from the top. A number 80 drill will clear excess solder from the holes after the pins have been removed.

A similar method is sometimes used to replace components such as resistors and capacitors from the top of the board. Use diagonal cutters to cut away all of the component except for the leads, which are left sticking up out of the board. The new part is then soldered to these leads.

Troubleshooting problems can be solved. It takes courage and resolve combined with a little know-how, plenty of time, and some luck. But the satisfaction of seeing a piece of gear come to life through your own efforts is one of the rewards of amateur radio you don't want to miss. ■

Hugh Wells W6WTU
1411 18th Street
Manhattan Beach CA 90266

Dry Cell Tester

Sort Out Those Dry Cells and Become a Household Hero.

How often do you have dry cells (1.5 volt flashlight batteries) lying around that have been pulled from hand-held radios, DVMs, ohmmeters, flashlights, kids' toys, etc? If your situation is anything like mine, dry cells seem to appear out of thin air and, of course, their condition is always unknown. To combat the continuing problem, a dry cell tester (Fig. 1) was designed and constructed. The criteria dictated simplicity of operation so that any member of the household could use the tester. Therefore, need to interpret a meter scale was avoided. Of course, an electronics-oriented person prefers the analytical/diagnostic characteristics provided by a voltmeter.

How it Works

The tester is basically a "go, no-go" device using two pilot lamps as indicators. One lamp is connected directly across the cell being tested to indicate when a good connection has been made (assuming there is enough charge remaining to light the lamp), and to provide an initial load for the cell. The second lamp is used as an indicator for the GOOD/BAD decision.

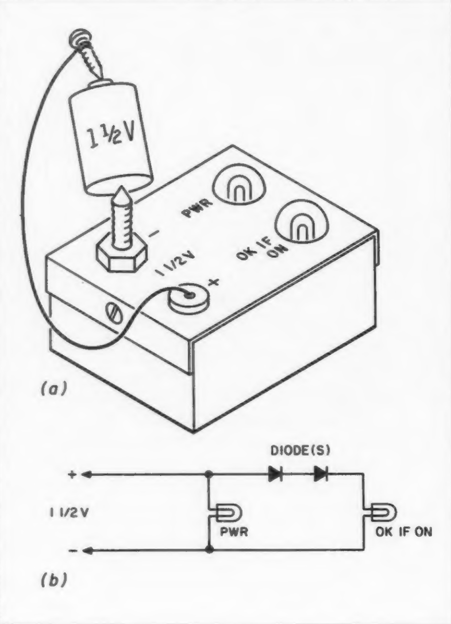

Fig. 1. Dry cell tester (a) mounting, and (b) construction.

One or two diodes are placed in series with the decision lamp to provide a voltage threshold for lamp turn-on. The decision lamp will then glow according to the cell condition (voltage level under load). It is assumed that the cell is "good" if both lamps glow, and "bad" if only the power lamp glows or is extinguished. The lamp intensity will always be low when testing fully charged nicad cells, as the cell voltage at 1.2 volts is marginal for the decision lamp.

Different lamp types have different voltage threshold values to produce a visible light output (See Table 1). The visibility of the light output is divided arbitarily into two categories for making voltage-threshold measurements for lamp and diode selection. The voltage drop, Vd, represents the voltage value required to observe a barely visible dull "red" glow. While the voltage, VL, represents a glow of "orange to yellow" for a "good" intensity level. The light visibility for lamps such as the #48 and #49 with long internal filament wires are much easier to see than the light from miniature lamps like the

Continued on page 55

Lamp	Rating		Glow	
	V	A	Vd	V
PR-2 (Calectro E2–430)	2.38	0.50	0.47	0.62
PR-7	3.80	0.30	0.47	0.62
#48,49 (Calectro E2–444)	2.0	0.06	0.50	0.65
RS272–1139	1.5	0.025	0.50	0.65
#114	1.2	0.20	0.50	0.65
PR-3	3.57	0.50	0.50	0.65
#14 (RS272–1132)	2.47	0.30	0.52	0.67
#222 (Calectro E2–451) (RS272–1124)	2.25	0.25	0.53	0.68
#223	2.22	0.25	0.80	0.92

Table 1. Lamp ratings.

Lamp (Qty)	1N92 (1)	1N92 (2)	1N4004 (1)	2N1305 (1)	HEP630 (1)
#48,49	R 0.9 Y 1.2	R 1.2 Y 1.5	R 1.35 Y 1.5	R 1.17 Y 1.5	R 1.0 Y 1.2
RS272-1139	R 1.0 Y 1.5	R 1.2 Y 1.5	R 1.3 Y 1.5	R 1.0 Y 1.5	R 1.0 Y 1.5
#14	R 1.0 Y 1.5	R 1.35 Y 1.5	R 1.4 Y 1.5	R 1.2 Y 1.5	R 1.1 Y 1.5
#223	R 1.25 Y 1.5	off off	off off	off off	R 1.4 Y 1.5
#222	R 1.0 Y1.5	R 1.35 Y 1.5	R 1.2 Y 1.5	R 1.2 Y 1.5	R 1.1 Y 1.5
#114	R 1.0 Y 1.5	R 1.35 Y 1.5	R 1.35 Y 1.5	R 1.2 Y 1.5	R 1.1 Y 1.5
PR-2	R 1.15 Y 1.5	off off	off off	R 1.35 Y 1.5	R 1.25 Y 1.5
PR-3	R 1.1 Y 1.5	R 1.4 Y 1.5	R 1.45 Y 1.5	R 1.4 Y 1.5	R 1.15 Y 1.5
PR-7	R 1.0 Y 1.5	R 1.35 Y 1.5	R 1.35 Y 1.5	R 1.2 Y 1.5	R 1.1 Y 1.5

Table 2. Voltage relationships for lamp/diode combinations.

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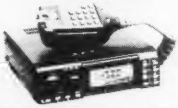

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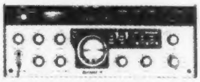

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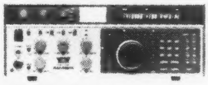

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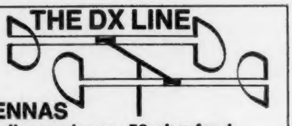

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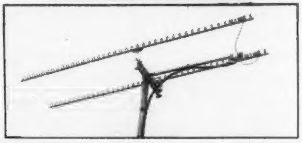

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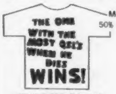
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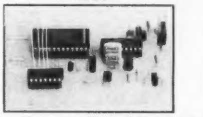

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On the *73* August Packet Issue

As I flipped through *73's* latest Packet issue, I came across a few items that I felt needed to be set aright. Here they are:

The article *Future Packet* in the August *73* issue warrants some discussion. First, the author states that "the latest PBBS listings show more than a hundred now in operation." The W9ZRX listing as of April 1987 shows *404* in North America.

Next, the author touts the work of VE7APU a few times without once mentioning that the author sold the only commercially-available TNC based on VE7APU's hardware and software through a company called Bill Ashby and Son. While attributing the growth of packet to VE7APU, the author mentions a negative force; "a steady, well-implemented, and self-serving promotion, by various groups and suppliers of packet equipment which has created the impression that their TNC makes every station a repeater...". It would appear that this refers to the rest of the packet industry, since all of them allow digipeaters, and many include the KISS interface used to support TCP/IP, and all TNC-2 clones support NET/ROM. It must be kept in mind that the author was still advertising in December 1986 a VADC-style TNC.

The author has missed the growth of NET/ROM, TCP/IP, and TEXNET; the use of the wormhole (a satellite link between the east coast and west coast), the molehole (late-night phone links connecting NET/ROM nodes), and the Georgia 56-Kb modem.

Finally, the author mentions the ARRL Digital Committee. He says that we can't wait for this committee to agree on a level-3 network protocol, and that they've been discussing it for five years. If the gentleman really knew what the committee was up to, he'd realize that it is not the committee's *intent* to mandate a single level-three protocol. The author appeared to have a tunnel vision view of the committee—he missed mentioning Terry Fox WB4JFI, the primary author of the AX.25 specification; Lyle Johnson WA7GXD, developer of the hardware that took packet out of the hands of the few into the hands of the many; and several other people who played the real roles in changing packet from a little-discussed hi-tech preserve into a new mode for the general amateur community. I invite the author to attend some meetings; there is always one in conjunction with the ARRL Digital Communications Conferences.

The third article in the issue is several pages of BBS and Digipeater listings. The listing is difficult to use because it is sorted by callsign instead of State and City. Occasionally, because of the licensing system which allows hams to retain their original call sign even when they move to a different region, there will be a digipeater or PBBS listings in a less-than-obvious place. For example, for a digipeater in South Dakota, KA6DAC-1 is less than obvious sorted in with the sixes.

I decided to write these observations in my column as a result of some inquiries to me from fellow packeteers. Sometimes, misleading information *can* get through in articles, so I felt compelled to offer this rebuttal.

I like the ARRL and am on the Digital Committee, but I don't think *QST* has the panache to let their columnists take a poke at their editorial management.

Questions

I'm working on some graphics for the intro to NET/ROM column, so this month we'll close by answering questions from the mail.

I recently got a letter with several questions from Joe Cygman, a non-ham from Montreal. My hope is that the digital aspects of amateur radio will bring in new hams, so I'll answer these in detail in hopes that other non-hams might get interested.

Joe wants to talk to a relative in Calgary, a distance of 3000 miles. Assuming they both get licenses and the proper equipment, his questions are:

"Can we communicate in real-time, or is it only possible via PBBS systems?" Yes, you can communication in real-time. To do so today you'll have to use the HF bands. You'll either do this directly, or via HF gateways. For direct communications, you'll both need HF radios. If all you want to do is chat, you'll get more chatting done using regular voice. If you want to exchange programs or data, packet is a good way to go. To use HF gateways, both of you have to find HF stations in your local area that allow gatewaying, and can connect to the other station. An HF gateway has two radios and TNCs, one set on HF, and the other set on a second frequency, usually 144–148 MHz. Since this is an expensive proposition, most stations so equipped are used for store-and-forward messaging, which is somewhat more efficient. These stations usually do not allow gatewaying, so it is unlikely that you will find stations in Calgary and Montreal that will work for you. In the future, satellites may also provide a path between Calgary and Montreal, but it will be many months before that comes to pass.

"In real-time, how long would it take a block of data to reach that distance (assuming no errors)?" The data rate on HF is 300 baud, or about 30 characters per second. Allowing for the acknowledgments and other overhead, you're probably looking at three to four minutes for 2k of data.

"Can I talk to the States and Europe the same way?" Yep. The HF bands can be used to talk anywhere, but various propagation effects limit when and how long you can talk between any two points. Packet is not unique in this, any good ham radio or SWL book will discuss propagation effects.

"What is the minimum configuration at what price?" I always hate this question. The answer depends on if you build, borrow, beg, or buy your equipment, if you buy used, new, or top of the line, and if you want to live with propagation, or make your own. For the non-ham, making your own propagation means using the highest power possible, the biggest antennas your local laws permit, and using expensive or custom-built modems that work in low signal-to-noise conditions. A TNC will cost between $139 and $300 depending on features. There aren't many used ones around. An HF radio can cost anywhere from $100 used to $2000 and up. You need reasonable stability for long-term packet use, which means the bottom of the line used won't do. I'd guess $300–$800 would get you a minimal HF radio. HF is not the cheap way to get started in packet. Used 144–148 MHz radios can be had for $75 to $200, this is the normal entry path.

"Is there any cost to using digipeaters?" There is no direct cost, i.e., you won't be getting a bill from VE3XXX for connect time or a per-packet charge. Keep in mind though that each packet resource, be it digipeater, network node, PBBS, or whatever, has some real hardware costs involved. Some nodes, such as those on mountaintops, TV towers, or other remote locations have recurring costs such as site rental, forest service fees, etc. Many such nodes are supported by clubs, formal or informal, and somebody somewhere is paying the bills. If you are a regular user of a node, you should check in to how the bills get paid. In some cases, you can join the club and support it that way. In other cases, you can offer the services of your four wheel drive jeep the next time the node requires service, or loan a used 10 MB drive to the local BBS sysop.

"How is a digipeater different than a gateway when going long distances?" This is almost an apples and oranges question. HF Gateways get you from one gateway to another in one hop, digipeaters take several hops to go long distances. There are no digipeater paths that run 3000 miles on VHF. Digipeaters have a natural limitation on the number of hops that can be used before the probability of getting a packet from one end to the other reaches zero. NET/ROM, which can be viewed as a "smart digipeater," can be used to reach much larger distances, since it can continue to function through a larger number of hops. There are no NET/ROM paths of 3000 miles either, but through use of a borrowed satellite link, two groups of NET/ROM nodes are linked on the east and west coasts of the US. This link is too far south to be of immediate use to you.

So, to sum up, if you want a real-time link today, you'll have to use HF directly. HF gateways would work in theory, but they are limited in number and may not serve your area. Something else to keep in mind for non-hams are the restrictions on the types of traffic that can be transmitted on amateur radio. For example, if you and your relative were both software consultants, you could chat about your jobs over amateur radio. You could not, however, both work on the same job, sending source code and specifications back and forth, to then be integrated and sold. You may not use amateur radio as a business.

Lap Tops

Ray Pitts, N6HDU, writes asking about compact computers for use with packet in a mobile home. Are lap models any good? Separating a general discussion of laptops in general from their suitability for packet, I can say that any lap top with a serial port should be fine for packet. The older laptops, like the Radio Shack model 100 all contain a built-in communications program in ROM that works fine. There was even a mini-BBS available for the MD 100 in the HAMNET BBS on COMPUSERVE. These are available for less than $400 in some places. The newer laptops are a full IBM PC, compatible in every way with normal-sized PCs. They are all big bucks, however. Most of the ones I've seen in amateur hands have been bought by an employer. There is a good deal of key clacking going on at most ham computer conferences now as people take notes or swap software.

No TNC

Bruce Langos N8CNZ asks if it is possible to receive packet without having to purchase a TNC. He has a PC and a modem. It is possible (almost anything is), but in most cases it's easier to just shell out the $139–200 for a minimum-feature TNC. Amateur packet doesn't use start bits and stop bits, it uses a frame format called HDLC, and an encoding format called NRZI. This also implies a technique called bit-stuffing or zero-insertion. All these things are described quite well in the any ARRL Handbook since 1984. While this scheme has its advantages, one disadvantage is that it usually requires the use of a special hardware chip to decode. IBM PCs don't have this chip as standard equipment. While it is possible to write a software algorithm which duplicates the hardware chip, it takes much of the processing power of your PC to do so. You end up with a $2000 computer emulating a $35 chip. Back in the early days, Bob Richardson wrote a software-only TNC for the Radio Shack model 2, but I don't think anyone has done it for the PC.

There are some inexpensive receive-only cartridges for the C-64, and I've heard of, but not seen, a software-only TNC for the Apple II done by a group in Germany. For the PC, you need some hardware. And just like modems, you can get an internal TNC board or an external TNC. HAPN in Canada makes an internal board with some nice features, it was discussed in the July 86 column. The cost is more than the cheapest external TNC, however.

There are some surplus Eagle Computer Boards around with an Intel 8530 chip on them—they can be turned into TNCs. KA9Q wrote an implementation of AX.25 in C which can be adapted to run with this board. The board was selling for less than $20.00 in Los Angeles a few months ago. You'll need a modem though, and your current modem probably won't work. Most regular 1200 baud modems use the Bell 212 standard. Packet uses the Bell 202 standard, which is very different. There are surplus 202 modems available, or you can build your own with a circuit described in the 1985 and later ARRL Handbook. As you can see, unless you get very good deals on surplus equipment or enjoy building your own, it's easier and cheaper, at least for the IBM PC, to buy a TNC. If you just want to evaluate your interest, borrow a TNC from a friend, or check out your local radio store. Three out of the four local stores in LA have demonstrators set up.

In closing for this month, remember that only letters with an SASE stand a ghost of a chance of a reply, although you may get an answer in the column. It's not the expense; I just can't remember where the envelopes are buried in the general rubble here.■

Dry Cell Tester

Continued from page 48

RS272-1139. However, the miniature lamp works quite satisfactorily as an indicator.

Part Selection

To accommodate the threshold differences of lamps, it is necessary to select a particular diode (or two) to be used in series with the decision lamp. The diode selected, though, must be capable of handling the lamp current. In general, two germanium diodes are preferred over a single silicon diode since a fairly critical decision voltage is required to discriminate between a good and bad cell. A typical silicon diode will drop aproximately 0.7 volts while two germanium diodes in series will drop about 0.6 volts.

Regardless of the diode used, the forward voltage drop across the diode will be dependent upon the lamp current and the shape of the diode's forward saturation knee. At the low lamp currents, the forward voltage may be slightly less than the typical 0.3 or 0.7 volts respectively for germanium and silicon. Because of the various shapes of the diode knee vs. current, it is difficult to select a particular diode without experimentation. The base-collector junction of a 2N1305 (RS276-2007) germanium transistor was found to have nearly the same voltage drop as two 1N92 diodes connected in series.

> *Construction of the tester is intentionally simple, with a small box used as an enclosure.*

If the cell voltage exceeds 0.6 volts (two germanium diodes), current will flow through the decision lamp but the lamp will not have a visible glow until the cell voltage is above approximately 1.2 volts. The higher voltage drop of a silicon diode would cause the lamp to be dimmer in most cases. Nine lamps were categorized and listed in Table 2 to show the variables of lamp vs diode/voltage to assist the builder in selecting matching parts. The #48 or #49 lamp used with two 1N92 diodes is the preferred combination, but other combinations will work fine with some experimentation.

Construction

Construction of the tester is intentionally simple, with a small box used as an enclosure. The lamps are mounted (held) in rubber grommets with connecting wires soldered directly to the lamp bases. It is best to keep the heat to a minimum to prevent glass fracturing when soldering the lamps. If desired, the diodes may be mounted on a three-lug barrier strip to provide mechanical rigidity. Number 4 or 6 machine screws are sharpened to provide cell contact. The positive-terminal probe screw is attached to the end of a flexible wire which is made long enough to reach easily over the top of the dry cell.

Build this simple dry cell tester and put it to use in your house or ham shack. You can now clean up that pile of "unknown" dry cells on the workbench as well as those left in the refrigerator since Christmas. Become the household hero!■

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UHF	$980	$730

(Also available for commercial bands!)

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FEATURES:
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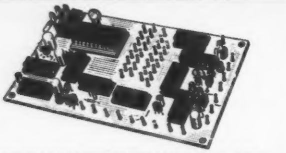
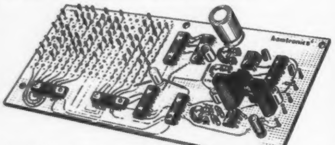
- **SELECTIVITY THAT CAN'T BE BEAT!** Both 8 pole xtal filter & ceramic filter for >100dB at ±12kHz. Helical resonator front end to combat desense & intermod.
- **Flutter-proof squelch**, Automatic frequency control, separate spkr amplifier.
- **CLEAN, EASY-TUNE TRANSMITTER**, up to 20W output. 50W with additional PA.

ACCESSORIES



- **TD-2 DTMF DECODER/CONTROLLER kit only $78. Full 16 digits, 5 functions, toll call restrictor, programmable. Much more. Great for selective calling too!**
- **AP-1 AUTOPATCH kit only $78. Reverse patch & phone line remote control std.**
- **AP-2 Simplex Autopatch. Use with above.**



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- **COR-2 kit**, $38. Audio mixer, local spkr amplifier, tail & time-out timers.
- **COR-3 kit**, $48, with courtesy beep.

- **MO-202 FSK DATA MODULATOR kit $38.** Run up to 1200 baud digital or packet radio signals through any FM transmitter.
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FEATURES:
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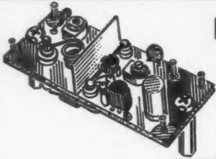
- **High Gain:** 13-20dB, depending on freq
- **Wide Dynamic Range:** to resist overload
- **Stable:** new-type dual-gate GaAs FET

* Specify tuning range desired: 26-30, 46-56, 137-150, 150-172, 210-230, 400-470, or 800-960 MHz.



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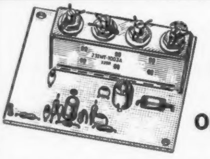

HRA -(*) HELICAL RESONATOR PREAMP

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Low-noise preamps with helical resonators **reduce intermod & cross-band** interference in critical applications.

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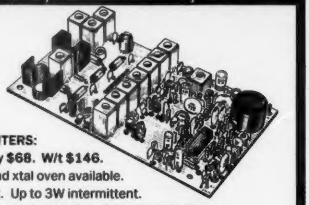
HIGH QUALITY XMTR & RCVR MODULES FOR REPEATERS, LINKS,TELEMETRY, ETC.



- **FM EXCITERS: Kits only $68. W/t $146.** TCXO and xtal oven available. 2W cont. Up to 3W intermittent.
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RECEIVING CONVERTER

VHF MODELS

Kit with Case $49
Kit less Case $39
Wired w/case $69

Antenna Input Range	Receiver Output
28-32	144-148
50-52	28-30
50-54	144-148
144-146	28-30
145-147	28-30
144-144.4	27-27.4
146-148	28-30
220-222	28-30
220-224	50-54
222-224	28-30

UHF MODELS

Kit with Case $59
Kit less Case $49
Wired w/case $75

Antenna Input Range	Receiver Output
432-434	28-30
435-437	28-30
432-436	144-148
432-436	50-54
439.25	61.25
902-928	422-448
902-922	430-450

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For SSB, CW, ATV, FM, etc. Can be linked with receive conv for tranceive. 1 to 2 W out. Linear PA's available up to 50W.

	Exciter Input Range	Antenna Output
For VHF, Model XV2 Kit $79 Wired $149 (specify band)	28-30	144-146
	28-29	145-146
	28-30	50-52
	27-27.4	144-144.4
	28-30	220-222
	50-54	220-224
	144-146	50-52
	144-146	28-30
For UHF, Model XV4 Kit $79 Wired $139	28-30	432-434
	28-30	435-437
	61.25	439.25
	144-148	432-436

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QRP

Mike Bryce WB8VGE
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BICYCLE MOBILE QRP

Well, let's face it. Sometimes ham radio can be as exciting as tapioca pudding. Summer always wins out over staying indoors and playing with the radios. But, if you're a QRPer, you know firsthand that there is nothing stopping you in taking the gear out into the world.

Small, lightweight QRP radios lend themselves readily to mobile/portable operation. Field day is a good example of the portability of low-powered equipment. Well, several months ago I mentioned that I like to go bicycling, and I have been working on a small transceiver to take along with me on the rides. I was thinking of riding out into the countryside, stopping, getting the radio out, and making a contact or two underneath a shady maple tree. Cam Hartford N6GA sent me a letter and asked if I would be interested in hearing about his efforts in bicycling and QRP, to which I enthusiastically responded.

Cam decided to go me one better. I was going to be extremely happy to be able to carry, set up, and operate a portable station while sitting under the ol' maple tree eating GORP (Good Ol' Raisins and Peanuts). Cam was going to operate while riding his bike down the road. Well, I'm impressed! So, in Cam's own words, here's the following on setting up a bicycle-mobile QRP station:

"I ride my bike for fun and exercise, not for speed. Most weekends, I go out for a 20- or 30-mile ride, with an occasional 50- or 100-miler thrown in, just to keep me humble. It was during one of these longer rides that the thought of integrating my two hobbies occurred to me. At the time, I was already in the process of building an ultra-compact 40-meter rig (Roy Lewallen's W7EL Optimized QRP transceiver, *QST*, August 1980) for home use. All I needed was an antenna, a matching network, and a method of keying the rig.

"The antenna was easy. I purchased a 40-meter mobile whip for a few bucks at the local flea market. It is a helically-wound fiberglass mast with a stainless-whip top section, and only weighs a few ounces. A borrowed rear bike rack, a Hustler ball mount, and the antenna portion was complete. The ball mount clamped to the rack very easily with two bolts and a short length of 1" x 1/8" steel bar. The only effects I feel when riding with the antenna aboard are from the low-hanging trees I neglect to avoid.

"Matching the rig to the load was a little more challenging. The antenna was resonant, but at a pretty low impedance. The bike, however, doesn't provide much of a mass at 40 meters, so the system impedance was pretty screwy. I tried several combinations of L networks, but didn't have much success with them. One combination seemed to provide a good match, but a check with the field-strength meter showed that the power must have been going into something other than the antenna. Maybe it was heating up the contents of my water bottle. It's always a good idea to use a field-strength meter in conjunction with the noise bridge and swr bridge in an antenna project such as this.

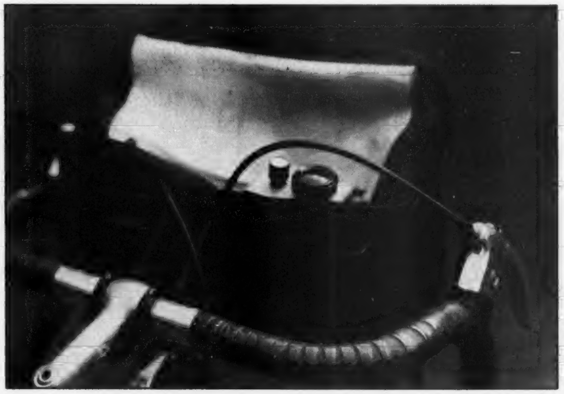

Photo A. The rig sits in the pocket of the handlebar bag and is easily tuned while riding.

Photo B. You've got to keep an eye out for low-lying power lines on this thing!

"Finally, in frustration, I set my MFJ-949 antenna tuner on the rear rack and put it in the line to see if it really was possible to match this thing. About thirty seconds later I had a good match and the field strength meter was off-scale. The MFJ tuner is not the kind of thing you want to cart around with you, so I duplicated its T-match circuit with some small air variables and a tapped toroid in a small Radio Shack project box. It works like a charm, is small, and very light.

"Once I got the antenna mounted and matched, I took off for a ride just to listen to the thing to determine if it was possible to copy CW while pedaling. I still don't know. What I had created turned out to be a very elaborate noise generator. I had expected the bicycle to be a very quiet radio environment, free of ignition, alternator, and all the other noises one associates with a mobile environment. Try to imagine the wheels spinning, their bearings making and breaking contact between the axle-bearing surface and the wheel-bearing surface. Also try to imagine the chain spinning around, each little link sporadically making contact with each other little link. Each contact made and broken represents a change in the impedance of the antenna; something like a loose connection in your antenna system. The direct-conversion receiver translates all of these changes into noise.

"At speed, with the wheels spinning and the pedals cranking, it amounts to about an S-9 noise level. Only the strongest of signals get through, leaving out most QRP-ers. Even when standing still, the simple act of turning the handlebars creates a good, solid S-6 hash.

"A quick check of a few older *Handbooks* didn't reveal anything that seemed applicable to this case. Wheel-hub contact springs just won't make it on a ten-speed. Bonding all moving parts together with copper straps would probably work, but what good's a bicycle with wheels that don't turn? I finally had the thought that part of the problem might be the direct-conversion receiver. While Roy's design is one of the better dc receivers around, it occurred to me that it might not be well-suited to this application. To find out, I tried some other rigs in the same environment. An HW-7, an HW-9, and a home-brew superhet receiver were all subject to the bicycle-mobile environment. The HW-7 flunked, exhibiting noise characteristics similar to or worse than the W7EL radio. The other two rigs, both superhets, were very quiet. Neither seemed to be affected by the moving parts of the bike.

"It now appears that my project list has grown to include an ultra-compact, 40-meter superhet transceiver. It could prove useful on Field Day, too!"■

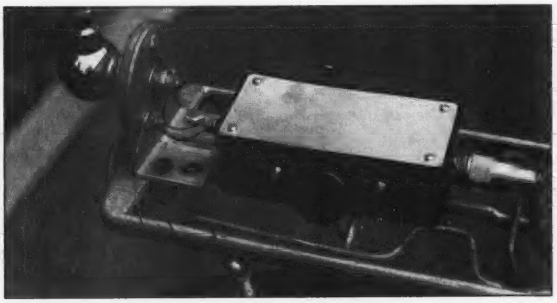

Photo C. Close-up of the antenna mount and matchbox.

WEATHERSATS

Dr. Ralph E. Taggart WB8DQT
602 S. Jefferson
Mason MI 48854

ANNIVERSARY

This is the first anniversary of the WEATHERSAT column and I must say it has been fun. I only hope that it has been useful as well. This month we are continuing with a discussion of the SMARTFAX concept, so, if you are tuning in after a break, you had better read last month's column to get up to speed. Last month we spent most of the time looking at hardware and software considerations. We will wind that up this month and then look at the construction of the SMARTFAX recorder—something that won't take long at all!

THE SMARTFAX RECORDER

The basic SMARTFAX recorder is a 240-lpm drum-type system using electrostatic paper that will print an 800-line image in about 3 minutes with near photographic quality. The basic mechanics for the recorder involve simple items such as a plastic rolling pin, aluminum angle stock, and other hardware-store materials. The construction of the recorder mechanics is fully described in the *Weather Satellite Handbook (WSH)** and although it is simple enough, the documentation is too lengthy to repeat here. The important thing to note is that we are going to build only the basic mechanics package—not the video, control, timebase, and drum amplifier circuits. You will be using the mechanics but essentially none of the electronics, with the exception of the 300–350V supply for the stylus.

The total cost of the recorder, everything included, should be well under $200, with the major items being the 240-rpm synchronous motor for the drum and the 40-rpm synchronous motor for the stylus drive. Both of these items can be obtained from the Hurst Manufacturing Company, outlined in the *WSH*. Metsat Products, one of the suppliers listed in the book, still has a stock of high-torque motors left over from final production of their FX-3 FAX recorder, and these can be obtained at a considerable cost-savings over new Hurst units.

The electronics for the recorder are shown in Fig. 1. For any of you experienced with FAX systems, they will look totally inadequate, but have faith. In a short while I will show you how we can do without most of the circuits you are used to seeing.

Motor Drive

In this system, both the drum and stylus drive motors are operated directly from the ac mains, a departure from conventional FAX practice where the drum is driven, via an ac amplifier, from a precision frequency source. Ac comes from the control unit (see packaging below) and normally will be applied through a relay (K1) when the control unit is turned on, applying ac to both the drum and stylus drive motors and activating the unit. Exceptions to the normally ON condition are covered in the *Safety Interlock* discussion below.

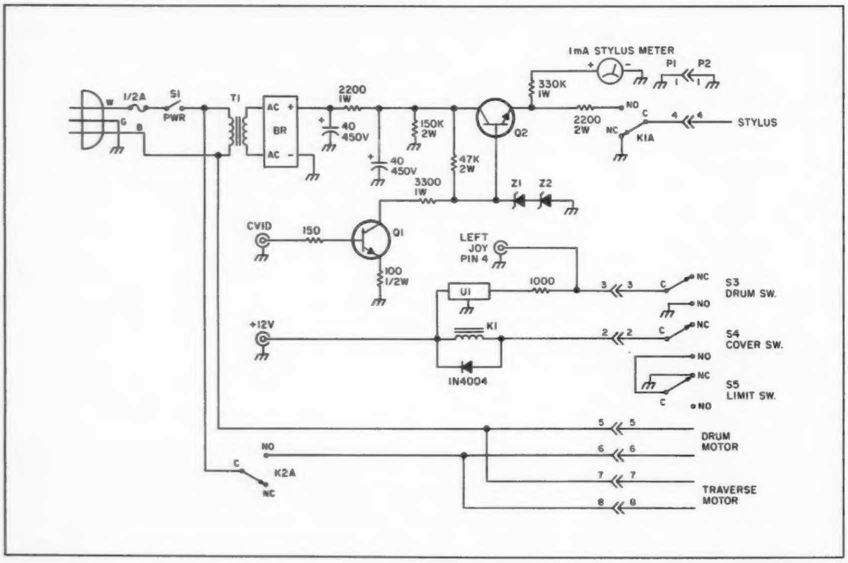

Fig. 1. SMARTFAX electronics. T1 is a transformer that will deliver between 200 and 275V on the secondary at 100–150 mA. BR is a bridge rectifier assembly rated at 600V and at least 1 Amp. Undesignated resistors are 1/4W. Z1 and Z2 are 120V 5W zener diodes (SK120X/5158A or equiv.). Q1 is a 10W, 300V (1A) transistor (SK3044 or equiv.). Q2 is a Motorola S5020 but any power transistor with a collector rating of 500–700 volts can be used. K1 is a 12-V-dc DPDT relay, the stylus voltage meter is a 1 milliamp panel meter, and U1 is a 7805 5-V-dc regulator. P1 is a Cinch Jones S-308-AB chassis mounting socket (control unit) while P2 is a P-308-CCT cable mounting plug for the 8-conductor cable from the printer mechanics. S1 is a SPST toggle switch while S3–S5 are SPDT microswitches. Wiring to P1 and P2 and the microswitch designations and wiring match the system described in the WSH.

Printing Driver

The paper used in this recorder (paper sources are covered in the *WSH* documentation) requires that printing voltage be applied to the grounded paper surface from a wire stylus. The printing voltage must vary from about 240V for black to 30V for white and must be controlled from the output of the D/A converter in association with the computer. In the case of the CoCo, the video control voltage (CVID) is available directly from the cassette output line with no additional hardware required. The operation of this circuit is identical to that of the normal *WSH* printing circuit except that in this case we get our video drive from the computer, not the FAX video circuits.

The modulated stylus voltage from Q2 is routed through the second set of contacts of K1 as part of the safety interlock system, described below. Meter M1 provides a relative indication of stylus printing voltage for system setup and to verify printing.

Drum Position Indicator

Virtually all drum-type FAX systems require some means to indicate when the drum has reached the position that should be the start of a line. This can take many forms. In the first version of the SMARTFAX recorder I used a simple microswitch activated by a cam on the drum shaft. The cam was positioned so that the switch would close, grounding the "phase" line, just as the stylus started to traverse the left edge of the paper. The first pictures had a very pronounced "jitter" that I thought might be due to irregularities in the closure of the switch so I changed the system to the use of a small magnet, mounted on the drum, and the use of a small Hall Effect sensor that would put a logic LOW on the "phase" line. The "jitter" was still present and turned out to be due to a slight binding of the drum shaft! A simple switch *will* do the job although you could use a magnetic switch, a magnetic Hall Effect sensor, or an optical sensor. The switch (S3) approach is shown, but regardless of what you use, you want the "phase" line to go to ground or a LOW just as the stylus starts its scan of the paper. The "phase" line is connected to the left joystick port of the CoCo (what would normally be the joystick "fire" switch) and the computer can easily sample this line to determine the start of a video line.

Safety Interlock

Two "bad things" can possibly happen during recorder operation. One is if the stylus carriage reaches the end of its travel and the system keeps on running. This can happen if you leave the room for coffee, if you aren't watching, or if you failed to reset the stylus carriage before printing. Consequences are not good in this event as you will grind away at the drive rod, probably burn through the recording paper as the stylus prints away while the carriage is stalled, and you will cause the stylus drive motor to soak up lots of excess current.

Bad thing number two occurs if you touch the stylus during printing. 240V or even less can be fatal!

Both of these bad things are eliminated by a safety interlock system consisting of two microswitches (S4 and S5). Both are in series with the coil of the 12-V-dc control relay, K1. K1 must be closed to apply ac to the drive motors *and* printing voltage to the stylus. The interlock system is based on allowing K1 to close only when everything is just fine but forcing it to open if things are somewhat less than fine. Less than fine is defined by the status of S4 and S5. S5 is located at the end of the stylus track and is wired using the common and normally closed contacts of the microswitch. The switch is positioned so that the carriage will cause the switch to close, breaking the series ground to the coil of K1 when the carriage reaches its limit of travel. This would cause S5 to open, would release K1, and thus shut down the motors and remove voltage from the stylus.

S4 is wired using the common and normally open contacts of the switch and the switch is arranged in conjunction with a cover of plexiglass or other rigid material so that the switch will close when the cover is on place over the drum, shielding you from accidental contact with the stylus. If you fail to close the cover, K1 will not pull in, the stylus will be held at ground, and the motors will not run. Open the cover partway through printing and the system will also shut down.

The interlock system is designed to protect both you and the hardware, not to mention uninformed visitors to your station. The cover interlock is a *must*. You should omit the "end of travel" function only if you know that you will never forget or be called away. Since that is not realistic, a buck or two for microswitches is a prime investment in peace of mind! THE UNIT IS NOT SAFE TO OPERATE UNLESS THE INTERLOCK CIRCUIT IS FUNCTIONAL. DISABLING THE INTERLOCK FUNCTIONS MAY RESULT IN DAMAGE TO THE UNIT AND COULD PROVE FATAL.

Packaging

The power supply, printer driver circuit, meter, and power switch were all placed in a small metal cabinet—almost anything will do. Connection to the actual recorder mechanics package is via a 6-conductor cable. The cable originates at the printer and has a Cinch-Jones plug (P-306-CCT) that mates with a socket (S-306-AB) on the rear apron of the cabinet. You must *not* use a plug at the recorder end since the exposed pins would be carrying both 115 V ac and +300 V, both of which are hazardous to your health. Any ac and HV connections at the recorder should be enclosed in a minibox or other grounded cabinet for safety.

A shielded audio line (phono plugs at either end) carries the cassette output line from the scan converter to the SMARTFAX cabinet (CVID). Another shielded line, with a phono plug at one end and a 6-pin DIN plug at the other, routes the "phase" line from where it enters the SMARTFAX cabinet (from the recorder) to the left joystick input of the CoCo where the "phase" line is connected to what would normally be the "fire switch," if we were actually using a joystick.

Construction and Setup

The *WSH* provides a detailed description of the construction of the recorder mechanics. Wiring of the control cabinet is straightforward with no necessary cautions other than those normally associated with ac and HV wiring connections. Q1 and Q2 can be wired into a piece of perfboard mounted on standoffs.

Without connecting the recorder, turn the recorder power switch (S1) on and observe the stylus meter (M1). You should obtain a reading of approximately 0.7. A voltmeter should be used to carefully (= safely) measure the voltage between pin 2 (+) and pin 1 of the recorder socket. You should get a reading of about 240V. With equal care, measure the ac voltage between pins 5 and 6 of the same socket—you should get something between 110 and 120 V ac, depending upon your local mains supply. Now turn the power switch off. The ac voltage should drop immediately to 0 and no high voltage should be present between pin 2 and 1 (measured previously). The stylus meter should still be indicating voltage but this should taper off within a few seconds unless you have omitted the bleeder resistor on the HV supply.

At this point you can plug in the cable from the recorder. With the power switch off, block the stylus arm up so the stylus will not touch the drum, and reset the stylus carriage. Close the cover and turn the power switch on. The drum should immediately begin to rotate toward the back of the recorder and the stylus carriage should begin to move along the track. Open the cover and both motors should stop. Close the cover and allow the carriage to move down the length of the track. While it is running you can use an ohmmeter to verify that the "phase" line to pin 4 of the recorder cable socket is being pulled to ground (or LOW) once each drum revolution. As the carriage reaches its limit of travel, it should activate the limit switch at the far end of the track, and again both motors should stop. If either motor turns in the wrong direction, recheck the wiring. If either interlock fails to function, unplug the recorder cable and carefully check the wiring and/or placement of the cover and limit switches.

Software

Prior to the final description of using the SMARTFAX recorder, a few notes about the operating software are in order. The SMARTFAX software is available as an option that can be grafted into the standard Version 4 software which I supply for the CoCo version of the *WSH* scan converter. The standard Version 4 software is available for $30 on cassette or $40 in EPROM. For the SMARTFAX option, simply add $5 to the cassette or EPROM pricing. The SMARTFAX option is called from the Main Menu, at which

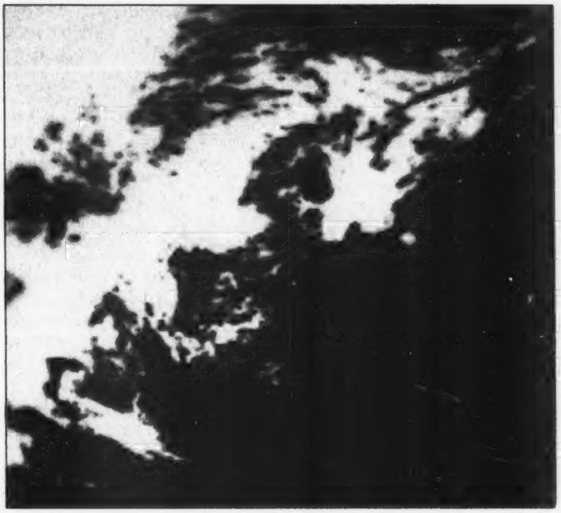

Fig. 2. A METEOR 2-15 image from the WSH *scan converter which was dumped to a 120-lpm Alden WEATHERCHART recorder. The major disadvantage of the Alden, aside from the longer printing time, is the fact that the Alden printing circuits are optimized for binary printing of weather charts and the mid-range video values are hard to display. This is the same pass shown in Fig. 2 last month, but that image was printed on the SMARTFAX recorder which is optimized for grayscale output. If I were to use the Alden unit on a permanent basis, I would redesign the printing circuit for linear grayscale response. Dumping to the Alden from the* WSH *scan converter presents no real problem—just slightly different software. Baseband video was used for this print, but the output signal from the computer could just as easily be converted to subcarrier FM for direct input.*

point the computer will output white-level video and wait for you to turn on the control unit to start printing. The software will hold a constant white level until the computer detects eight pulses on the "phase" line, which provides enough time for all of the motors to come up to speed. At the ninth pulse, the computer will begin to dump lines to the SMARTFAX recorder. With each pulse the computer will proceed to step through 1000 pixels of data (500 bytes) using the normal clock signal from the scan converter to time the dump. After 500 bytes the computer will jump ahead 12 more bytes in memory and wait for the next line pulse from the recorder. This is how we can use the ac mains for running the drum since the computer dumps the first 98% of each image line and then waits for the drum to finish a revolution before starting the next line. Thus, while the drum may run either fast or slow in absolute terms, the computer is dumping to the drum in a triggered mode and we get a properly synced image despite a slight "wandering" of the ac drive frequency. The loss of the last 2% of each image line is a small price to pay for the convenience of using the ac mains for power!

Use

The *WSH* has a rather complete description of the paper-loading sequence. You simply need to be sure that the cable from the mechanics is plugged into the control unit and that the cables to the cassette output and left joystick input of the computer are in place. Load a sheet of paper, reset the stylus, and forget about the printer until you see an image you want to save!

Assuming you have an image "frozen" on the display, key in the SMARTFAX option from the Main Menu (#8) and turn on the SMARTFAX control unit. As the drum comes up to speed, you will see a few white lines as the computer counts drum pulses and it will then begin to print out the picture. When all 768 image lines have been dumped, the computer will switch back to constant white output (which will be evident on the paper and on the printing meter) and you can switch off the control unit and remove your print. If you forget to switch off the printer, the end of travel interlock switch should shut the system down for you.

If you haven't closed the cover prior to turning the control unit on, the system will not print but there is no need for panic—the computer will *not* start the dump until the drum has been running for eight revolutions. Simply close the cover and printing will begin normally. If you want additional copies, simply reload paper and print another.

Normally, I will keep the system loaded with paper at all times so that I can print a desirable picture with minimal delay. It may seem strange to be printing pictures *after* they have been transmitted, but you will certainly appreciate being able to decide whether a picture is worth saving without having to use up paper to do it!

Pix of the Month

Fig. 2 is provided for the benefit of those folks who want to see what a non-satellite FAX machine can do. In this case, the FAX system is the Alden Weatherchart recorder (120 lpm) while the image is a METEOR product! The software in this case provides an initial phasing signal to allow the image to be phased on the Alden, a 120-lpm dump rate (all 1024 pixels/line), and repeats each line twice to get the proper aspect ratio. The only disadvantage in the case of the Alden is that the dump requires about 12 minutes instead of the three minutes needed for the recorder described this month.

I think you will agree that SMARTFAX is a very effective merger between the viewing ease and mode flexibility of scan converters and the high-resolution printing capabilities of FAX recorders! I would definitely suggest that you look at the possibilities presented by the SMARTFAX concept, for the results are certainly superior to basic photography or video printers.

Next month we will have our first encounter with the wonderful world of digital image processing.■

* References to *WSH* are to the Third Edition of the *Weather Satellite Handbook*, available from the author for $12.50 plus $1 shipping and handling in the U.S., and $2 elsewhere.

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Please rate any ham gear you're using from (0) poor to (9) superb.

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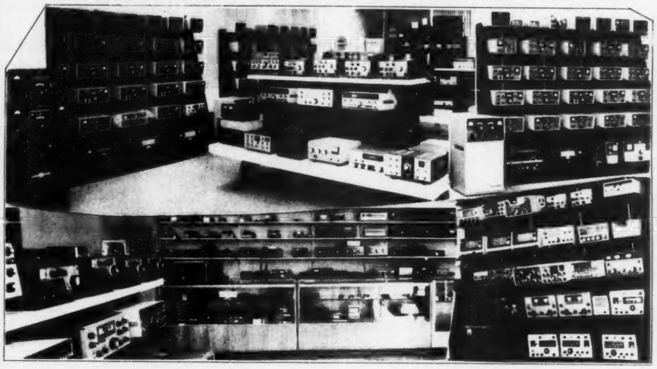

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NEVER SAY DIE

from page 42

ally seen a memo of agreement with an undisclosed investment group to sell them the amateur 2300 MHz band for an undisclosed sum. Rumors put the deal in the $500 million range. I sure hope this isn't the usual leveraged buyout, complete with junk 2300 MHz bonds.

The League, I believe, claims that since its 145,000 membership represents almost 100% of the actually active amateurs, it thus has the right to enter into a contract to sell the amateur bands on behalf of all amateurs.

I don't think any of us have any argument with the reported proposal to earmark $50 million of the proceeds for updating the ham shacks of League officials, directors and vice-directors. They, obviously, as our representatives, should have the very best in equipment and antennas. Nor have we any problem with the proposed new $100 million 30-story headquarters building, museum and visitor center, including a new W1AW, with operatorless computerized continuous CW operation on all bands, complete with the automatic printing and mailing of the QSLs. It's about time, really.

I personally feel that $50 million set aside as an additional retirement benefit for headquarters staffers could be trimmed a bit. I also feel that the proposed $1,000 for the promotion of amateur radio might be increased—perhaps even doubled—or at least made a yearly investment.

We've been wanting to be able to have special call signs for several years, so an investment in a computer system to permit this innovation is long overdue. I believe that by charging $1,000 for each special call, the investment could be returned in just a year or two. It doesn't take anything to stir up controversy with some ops—such as the proposal that charges for special calls be graduated according the number of call characters. A six-character special call might thus cost only $100. A five character $500. A four character $1,000. Three might be $5,000. Two might be $10,000 and one might be $100,000. Cheap enough, I say. I know I'd jump in a minute for "W"—even at $100,000. I don't think I'd go more than $50,000 for "K"—and they can take "N" and shove it.

Hey, now that our call numbers are meaningless, why not start issuing five letter calls—like WAYNE? GREEN? I'll take two of those. Too bad if you have a long name—hey, don't blame me, that's your folks fault, so worry them about it. Change your name—it's not difficult. Or start going by a "sine" like the old CW ops. I've been a W2 in the W1 district for 25 years now, so what do numbers tell you anymore?

If they really are selling that stupid band which we've never used and which we'll probably never use, I wonder what they'll do with the rest of the money. Wow, what a party we could have!

> ***"The food was okay—most of it on par with a cheap American diner—plenty of it."***

Or how about official ARRL DXpeditions to the top 100 most wanted countries? With a budget of $100,000 for each trip that would only run $10 million—peanuts. But it sure would get DXing back into the spotlight. We'd want to make sure that the DX operation was totally automated though, with each contact kept down to one or two seconds so eager-beaver DXers could work 100 rare countries in 100 seconds. That'd sure make the papers. Think of the thousands of CBers we'd suck into the hobby with a deal like that! Maybe tens of thousands. We might even attract some of those thousands of stuck-up 10.5 meter ops. I wonder if we could locate L. Ron Hubbard's old ship and set it up for DXing? Was it the *Excalibur*, named after his book? The old *Excalibur* was the flagship of the American Export Steamship Line, which used to be America's biggest passenger line. The *Excalibur* was sunk off Northern Africa in WWII, as I recall.

Isn't it about time we put those three stationary synchronous satellites up so we can contact anyone in the entire world using microwaves? A project like that would eat into the kitty—particularly if we do it right. I'm talking a major computer system to control the satellite relaying—one which could keep every active amateur's location noted with store and forward features for messages. All these newfangled ideas take is some money to make them work.

Of course, if we're going to start using satellites for any volume of communications, we might just have a need for the 2300 MHz band and regret selling it.

How about you—what would you like to see done with an extra hundred million or two for the League to invest in the hobby? Let me know what you think. Also, if you believed the above, I've got a famous old bridge in New York which we're forming an investment team to buy, set up a toll booth and make a mint.

Wayne in Yalta

Old-timers, which includes most of us hams who are still left today, will remember the old black and white TV sets with controls for vertical and horizontal sync, vertical and horizontal linearity, focus, brightness, contrast and so on. The almost forgotten old TV days came rushing back recently when I turned on a TV set in Suzdal, Russia. I was back forty years to my first TV set! The old 630TS.

I was sucked in when a travel brochure came inviting me to join my RPI alumni on a two-week trip to the USSR. The price wasn't too bad, and I've somehow managed to miss visiting Russia before . . . so, what the heck, right?

My first move, over three months before the trip, was to write to the head of amateur radio in Russia, Yuri Zubarev, and ask to meet him during my visit. I also wrote Box 88, as a backup. And, just to try and cover all bases, I quickly answered a timely offer to help with material for *73* from Information Officer Andrei Baidak of the Soviet Embassy with a third request to see hams during my visit—mentioning I'd written Zubarev.

Not hearing from Andrei after a month, I started trying to reach him by phone at the Russian embassy. After two weeks of either busy lines or no answer at all, plus sending him two telegrams—I was told that Andrei had returned to Moscow—permanently. A few weeks later, when I finally reached his replacement, Michael Nakoryakov, he said he was very sorry, but it was too late now to do anything.

A note from Radio Sport Federation VP Kazansky, replying to my letter to president Zubarev, said sorry, I'd have to use diplomatic channels—period. I was disappointed, but not really surprised.

Pat McGovern, the International Data Group chairman, suggested I try Alexei Markov of the USSR Trade and Economic Council in New York—a contact that had worked well for him. A few days trying to reach Alexei got me the word that he, too, had been returned permanently to Moscow. When his replacement arrived and called, he asked for information on my background. He later called again to say he'd sent everything to Moscow and believed I would be well received there—and would call if he heard more. No call.

When the time came to go to Moscow I wasn't expecting anything more than a routine carefully orchestrated two-week tourist visit to Russia. There was no word from anyone while I was in Russia, so I just toured. They've worked out a program which keeps tourists busy almost every minute they're not sick—with long rides in hot buses with sealed windows, making it impossible to take many good pictures—lots of standing around waiting—and the only contact with the Russian people our carefully trained Intourist guide—who was not even permitted to give us her last name or address.

We had 36 in our group—just right for one bus—only five were RPI alumni, with the rest from other colleges. Most were retired and none with any interests I was able to discover.

We started out with two days in Moscow—a bus tour of the city where our guide identified and gave us the date of building and the name of the architect of every museum, church, government building, institute, and hospital as we zipped by—then we stood an hour on line in the hot sun in Red Square to see Lenin's tomb—yep, sure enough, there he was, nicely preserved, but NO pictures permitted—we were allowed five minutes to shop in the famed GUM department store. Yes, I said five minutes! A visit to three metro stations—which must have cost a bundle to build—'30s type decoration. Subway fares were cheap and trains came along every 90 seconds. No graffiti—yet.

So much for Moscow. The third day we made an all-day bus trip to Vladimir and then on to nearby Suzdal. We spent two days in Suzdal, a small town (11,000) whose only business is entertaining about one million tourists a year. Tourists are a major source of hard currency for the government, which it needs badly to buy state-of-the-art computer-controlled submarine propeller-making equipment from Japan. Suzdal was fun, with some people in costumes dancing, crafts people crafting, and so on. But two days?

Then one full day traveling—the five-hour bus ride back to Moscow with a bag lunch on the bus—waiting at the airport—a two-hour flight to the Ukraine—more waiting—a two-hour stifling bus ride to Yalta—arriving just in time for a late dinner. Two completely organized days at Yalta and then back up to Leningrad, north of Moscow. At Yalta there's a boat trip ($11 extra)—a city tour—museums and a swim in the Black Sea, which was cold and brackish.

The food was okay—most of it on a par with a cheap American diner—plenty of it. There are no bananas in Russia—come on, commissars, get your boy Castro on the ball. I was able to buy milk at a grocery store in Moscow, but it was never served in a restaurant. It was usually impossible to even get milk for coffee except at breakfast.

Being kept in a tightly controlled group with few photo opportunities may serve the USSR's purpose of getting hard currency tourist money, but it sure was frustrating for me. I knew I was seeing only what they wanted me to see—what they'd carefully planned for me to see.

They couldn't hide the endless queues for food—queues from one end of Moscow to the other—queues in every small town we passed. Queues even at midnight.

I didn't think it polite to bring up with our nice tour guide—the only Russian we ever spoke with—about Communism having never been a success as an economic system in any country it been tried. I read there are hopes that *glasnost'* will help, but I doubt it. I expect we'll see a repeat of the China pattern, where some free enterprise was permitted and then the inevitable reaction set in.

The insurmountable problem is simple. When free enterprise is allowed in a communist society the ruling group—the bureaucrats—the people enjoying privileges (big apartments, summer houses, cars, the best food, imported clothes, theater, etc.)—are unable to benefit from the change. They see new people achieving wealth and power and vying with them for the perks, which threatens their hold on the country, so they have to stop this nonsense. See if there isn't a government reaction against free enterprise in a couple of years in the USSR just as there has been in China.

Russia recognizes, as does China, that technology is critical for their future. Yet without changing their system they're not going to be able to generate the millions of engineers and technicians they need to cope with technology. Without another revolution there's no way their system can change—which is why the Chinese youngsters went into the streets in protest over their system—and were quickly shut up by the police. How long before Soviet students are threatening revolution? We'll see.

By the way, if you've worked much DX, you've contacted many Russian hams. Think about it—how many have you ever really talked with? It's my understanding from several sources that only KGB agents are permitted to have ham licenses which enable them to talk internationally, other than via radio club stations.

As our group went around we kept seeing opportunities for business. Someone will eventually invent Kleenex and make a bundle. Ditto American-style toilet paper. I saw no fast food stands in Russia, probably because so few people have cars and food is in such short supply. They haven't invented the superhighway yet—of course China has just barely invented roads, so I suppose Russia is ahead in that respect. But it sure makes for slow travel, with 30 miles in an hour about par.

Let's see what we can do when we hear a Russian radio club station to draw the operator into a conversation. Yes, I know most of their rigs sound so awful it's all you can do to make out the call and operator's name, but we need them to hear us more than we need to hear them. Tell them you'd like to get to know more about their country and their daily life—explain that your second car hurt itself pulling your boat, so you've had to make do borrowing your kid's car for a couple days or else give up picnic trips to the local lake. Tell 'em how frustrating it was yesterday when you had a two-minute wait in the check-out line at the supermarket.

Nah—I'm being rotten again. You just go ahead and make your usual one minute contacts and get your QSLs from Box 88 like you always have. Let's not try to use amateur radio to penetrate the Iron Curtain. And, no way send any Green QSLs. Senator Humphrey suggested I bring up the subject of their getting the hell out of Afghanistan, but I think he may have been more interested in getting me out of his hair than improving my trip.

I attended a "cultural discussion" at Yalta where it was pointed out that Russians are great book readers, while the average American doesn't read books. I'll have to look up the statistics on that. Americans do read a lot of magazines—thank heavens. How about you, what's the last book you read?

I just finished Garrison Keillor's *Happy To Be Here*—wonderful book. If you haven't read his *Lake Wobegone Days* you're hurting. *Happy* is mostly reprints of New Yorker stories. What a wonderfully twisted mind Garrison has.

Now I'm reading "Practical Intelligence—working smarter in business and the professions" by Roger Peters. I read two or three books a month—mostly non-fiction—mostly on technology, education and business. No, I'm not average—never said I was—why would I want to be? Where's the benefit?

Speaking of Russian stations, why have you been lying to them every time you work one? You know as well as I that most of their rigs sound terrible, so why haven't you mentioned it? If you ever heard an American with a rig like that you'd let him know fast enough. Take off the kid gloves. Let's try to get them to get their act cleaned up. I think we should push 'em hard to actually talk with us too. I hate being nothing more than a potential QSL card for someone. Keep in mind that the USSR has been able to pour their money into the military—and stay in power—by continuously scaring the devil out of their people about the awful Americans who are threatening to attack them.

Let's see—from Yalta, where it was near 90 degrees, we bussed to Semferopol' and then flew to Leningrad, where it was under 50—where it was still light when we arrived at 12:30 a.m. Another day spent traveling.

Leningrad was shabby. The buildings all look pretty much the same—and all are in various states of poor repair. The clerks in stores and hotels are mostly unhelpful and could care less. Well, they can't be fired, so why make any extra effort or be pleasant? Smile? I don't think there's a Russian word for it.

Typical was Sherry's experience in the hotel book shop in Yalta. They had a nice looking book in English which I thought might be fun to buy. The shop was closed for inventory. Sherry tried the next day and found the clerk was there, but she said she was too tired to handle any sales. She said she'd been up until 10 the night before with the inventory—which wasn't true since the place had been closed and empty all afternoon and evening. Sherry asked when she could buy the book—maybe in a couple of days. This was a tiny shop where counting the books couldn't take more than an hour.

I'm sure the revolution seemed like a good idea back in 1917—it might have worked out great for Russia if they'd gone the democracy route. They had a problem with over 90% illiteracy and a country that was already far behind the industrial revolution.

Things didn't start off too badly, but the Stalin era was murder as he killed tens of millions—doing his best to wipe out the intelligentsia and intentionally starving millions of Ukranians to death. He made Hitler look like a piker.

What they have now is a drab country where no one seems to be happy and where they have to make do with a fraction of the conveniences we take for granted. Interminable lines are a basic part of their day. Cars? Only for a few bureaucrats. It's rare to even see kids laughing and playing.

Snack food? I saw none—no potato chips, no Doritos, no Fritos, not even any pretzels! Boiled potatos I saw. The toughest beef of my life I saw—almost every day on my plate. Cream for my coffee I never saw, occasionally some warm milk. Coffeemate? Ha! No wonder Russians go ape when they see our supermarkets.

I visited a Leningrad department store and found a Sony ICF-4900 9-band radio selling for $365. I had one with me on the trip which I'd bought a few years ago

Continued on page 91

DX

Chod Harris VP2ML
PO Box 4881
Santa Rosa CA 95402

SVALBARD DXPEDITION

Svalbard is a collection of more than 20 islands that lie as close as 10° to the North Pole, 500 miles north of Norway. Its northern extremity is but 400 miles from the North Pole, but the relatively warm Norwegian current provides a tolerable climate during the summer months.

Spitsbergen is the largest of the islands, about the size of West Virginia. It was first discovered in 1194, and rediscovered in 1596 by the Dutch. During the 18th and 19th centuries, Russians and Scandinavians trapped game in the region, but most development occurred after the discovery of coal there at the end of the 19th century.

The Treaty of Svalbard in 1925 gave Norway sovereignty over the archipelago, but permitted 40 other signatories access to mining and maritime rights. Only Russia took advantage of the terms of the treaty, sending as many as 2,000 coal miners yearly to the region, exporting 300–400 thousand tons each year. The Russians far outnumber the 1,200 Norwegians who inhabit the island year-round.

The climate is better suited to polar bears than people, with winter temperatures ranging from −10° to −40°. Summer temperatures run just above freezing: 40°–45°. The west coast enjoys milder temperatures, thanks to the Norwegian Current, but also suffers more storms. The eastern coast is far calmer and colder. Glaciers crawl down through numerous valleys, especially on the eastern side; many valleys on the western shore are ice-free. The small human population shares the island with a handful of mammals that escaped the years of heavy hunting: seals, walruses, polar bears, reindeer, and foxes. Some birds nest on the island, such as the eider duck (source of the famous down) and some gulls, but only the snowy owl and the ptarmigan stay throughout the long, sunless winter.

The Norwegian population usually includes a handful of amateur radio operators, many of whom use the club station, JW5E, or their Norwegian callsign with JW substituted for LA. Many of these operators use LA5NM as their QSL manager. These hams can be found on the lower bands during the winter months, and on the higher frequencies during the 24-hour-sunlight days of mid-summer. One regular visitor to the island in the summer is Kris Dabrowski SP5EXA. Here, he shares his experiences with 73 readers.

SP5EXA/JW's Summer in Calypsobyen, Spitsbergen

This year I learned that I was going to spend the summer on Spitsbergen only about one week before departure of the expedition, so from then on I spent all my free time on preparations. We left Warsaw on June 9th, and then spent one night in Moscow before we arrived in Longyearbyen, the largest city in Svalbard, via Murmansk, on the northern coast of Russia. On the 12th of June, Russian helicopters took us from Longyearbyen to our summer base about 100 km to the south: Calypsobyen.

This is the second geographical expedition of the University of Maria Curie-Sktodowska in Lublin, Poland. The expedition includes 13 people working in geology, botany, meteorology, etc. We live in one of several old wooden houses built here by English miners over 70 years ago. Last year we cleaned and repaired most of them so this season we found comfortable conditions inside. Weather is rather stable; temperature 0 to 4° C. When we arrived in mid-June, there was still some snow on the ground but it is melting very fast. Polar summer is coming.

I'm the radio operator of the expedition but I also help in some observations. Every 6 hours I measure the ground temperature at various levels about 500 meters away from our base.

I have two licenses. One is professional—LH6X—for contacts with Svalbard Radio (LGS) on channel 3, 1736/2456 kHz, or channel 17, 3645/3217 kHz, and with other groups on Svalbard. I'm in daily contact with the Polish Polar Station in Hornsund on the southern end of Spitsbergen, and with the Norwegian Polar Institute in Longyearbyen. My second license is SP5EXA/JW and I spend most of my free time on the amateur bands. My equipment is a Yaesu FT-757 GX and FC-757 AT antenna tuner. The transmitter is powered by a 165 Amp-hour 12-V battery which I charge every day with a power generator. The old generator is a constant source of trouble because it consumes almost the same amount of oil as the fuel and I'm restricted to use it only 2 hours a day until a helicopter or a ship brings more oil.

My antennas are an inverted vee for 80 meters, dipoles for 40 and 20 meters, and an old TH3JR. All antennas are very low: about 7 meters above the ground and not much more above sea level, due to the complete absence of trees or any other supports. Conditions are good this year and in my first 10 days of operation, I had over 2000 QSOs; EU 75%, JA 20%, USA 10%, and DX 5%. Sometimes I beat European hams in the Pacific direction thanks to one jump less to the North Pole. Mainly I operate CW around 14025 kHz at any time of day. I also like 21025 and 28025 kHz during rare evening openings for short skip to Europe. 7 and 10 MHz are very difficult. 1.8- and 3.5-MHz bands are almost dead thanks to the 24-hour sun. Sometimes I work SSB on 20 meters, but CW is much more efficient with weak signals.

I stay here until the 26th of August and will try to put my antennas a little higher. Unfortunately, I have not enough coaxial cable to put them really high farther than 100m from the house.

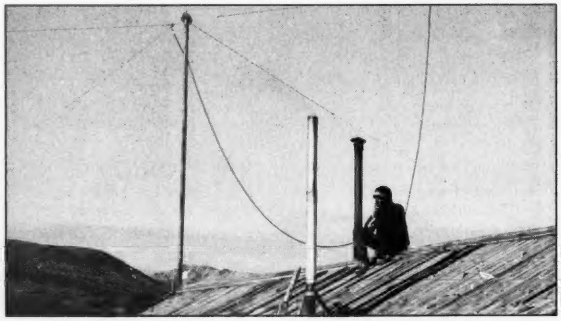
That is the story but still I have some more information: Calypsobyen is 77° 33′ North and 14° 32′ East in the Bellsund Fjord on the west coast of Spitsbergen island about 100km from any other people.

I do not have a QSL manager so please send cards via my home callsign, SP5EXA. [SP5EXA's home address is Kris Dabrowski, ul Senatorska 26 m 4, 00-095 Warszawa, Poland.] I'll also confirm QSOs with JW0EQ, my old callsign from wintering in Hornsund in 1984/85.

I have had to postpone my proposed expedition to Bouvet (3Y) because my family, XYL Regina and two daughters, Agues (10 years old) and Anna (8 years old), are getting upset with my continuous journeys. This is my 4th summer away from home.

By the way, Regina has already got her license, SP5SAD, and if anyone of my friends in Warsaw loans her a rig, I will be able to have daily contact with home.■

The Geographic Expedition of Marie Curie-Sktodawska University summered in Calypsobyen, on the shores of the Bellsund Fjord on the island of Spitsbergen.



Kris SP5EXA/JW atop his shack, surrounded by some of his dipole antennas.

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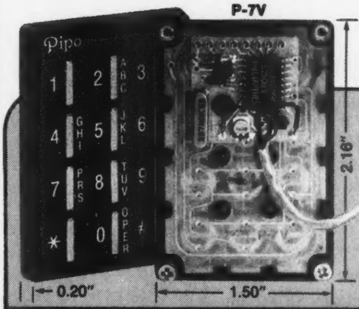

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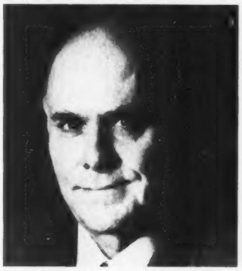

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ES EUPHORIA

As I write this (late July), we are in the midst of one of the more spectacular summer Sporadic-E seasons, with 6 meters having been open almost every other day to most parts of the United States, Canada, Mexico and Caribbean. Two meters has been in equally good condition, with many strong openings from the east coast into the midwest and southwest. Reports have been coming in of tremendous Es openings through the south into the Pacific area as well!

Concurrent with this information is what is possibly the first known 220 Es contact, made between W5HUQ/4 in Jacksonville, Florida (Grid EM90) and K5UGM north of Dallas, Texas (Grid EM12) during the June VHF QSO Party on June 14, 1987. At the time of the contact, there was a very strong opening on 2 meters that was allowing contacts from Florida all the way to Nevada and California for stations in the southwest.

Bill K5UGM tells of several attempts to contact John W5HUQ on 220 after hearing terrifically strong 2 meters signals. It took them 3 times, but as they say—the third time's the charm—and signal reports were exchanged at 15:44 UTC with John's signal hitting peaks of 40–60 dB over S9. At the time, tremendous E clouds were present throughout the southwest and southeast, so tropospheric ducting would seem to be ruled out. Bill also states that Rick K5UR in Arkansas (EM35) made a partial contact with K4DZP in Miami, Florida (EL96).Congratulations are in order for Bill and John! (Thanks to the Midwest VHF Report for this information.)

The June VHF QSO Party featured some truly unbelievable propagation, and subsequent incredible scores! It's entirely possible that all-time records were set during the contest that may never be equalled. Many stations are reporting early scores in excess of 750,000 points (only one station did so last year) and this is largely a result of the 50 MHz openings. Our group, WB2WIK/4, worked 204 grid squares on 6 from Chincoteague Island, Virginia with just a single 7-element yagi and 300 Watts. Other groups are reporting grid totals over 220—simply amazing. I've heard of grid totals on 2 meters in excess of 100 which would also set many records. Imagine working VUCC twice on six meters and once on two meters—all in one weekend!

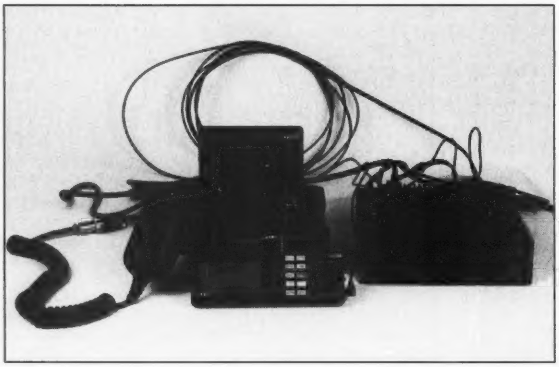

Photo A. The layout of the components of the IC-900 mobile rig. The band units (two black boxes at right) are stowed in an out-of-the-way place, such as the trunk. The interface (below speaker) goes inline between the control panel and the band units.

The great conditions have continued throughout June and July, with strong openings from the east coast into Texas, Arkansas and Missouri again in early July on 2 meters. It goes without saying that 6 meters has been open to most of the 48 states during the same period. Axel N8AXA writes in to tell of a strong opening from Dayton, Ohio (EM79) into Colorado, Kansas, Wyoming and Texas from 2210 UTC on June 29 to 0240, June 30. During this time, Axel worked 33 stations in 17 grids, most of which were new for him. Among the grids worked were DM79, EM18, DM78, DM91, DN70 and DN71.

Which brings us up to the CQ VHF WPX which our group KT2B just finished operating. Conditions weren't nearly as good, but we did have an excellent Es opening on Friday evening to the west coast on 6 meters. This occurred despite an incredible series of problems that had us all but ready to wave a white flag and surrender the 6-meter station to Murphy! Right off the bat we worked into EN61, EN51, DN91, CN84, EL97, and EM29—covering an area from Florida to Oregon with a few states in between.

Conditions were never as good again on 6 the rest of the weekend as far as we were concerned. However, I've received reports via K5UR and others that band conditions on 6 and 2 meters were spectacular all weekend long throughout the south, with double-hop Es from Georgia and the Carolinas to Utah and Nevada. On Friday evening, we did have a strong tropo opening into Ohio, Indiana and Illinois for about 3 hours on 2 meters, mostly yielding contacts along the Great Lakes.

For the rest of the weekend, we had to content ourself with calling endless CQs and pulling out the contacts one at a time. The only other strong Es opening on 6 meters came late Sunday afternoon when Northern Illinois and Indiana came rumbling in for about 30 minutes. It was fun to listen to John Lindholm W1XX and crew operating 4U1UN from the United Nations building. Boy, did they give a lot of folks on 2 meter FM a thrill! The 4U1UN gang probably copped the Multioperator/Multitransmitter trophy, as I heard unofficial reports of over 800 QSOs from their operation on 6 bands.

Activity levels were good for the WPX, with an awful lot of stations entering the Portable class. There were some real screwball prefixes on as well, such as NE3, WW4, KF6, etc. Our preliminary totals look like 450 QSOs and 195 prefixes on 6 through 1296. One major problem our group had was that the new UHF antennas for 432, 903 and 1296 didn't go up until Saturday morning—after a strong tropo scatter session on Friday night had run its course. And as I mentioned earlier, we had so much trouble with our 6-meter antenna rotor that we tried in order (1) A new cable (2) A home-brew brake line made from a 100-foot AC extension cord (3) A brakeline made from RG-8/U cable (4) Installing the rotor control box out by the tower and running outside to change it!

Add to this a blown GaAsFET in the first 6 meter transverter and some amplifier relay problems, and you can see why we were ready to call it quits. The only good thing about having the rotor outside is that the swimming pool was located right by it, and the oppressive heat kept us diving in all weekend! One real disappointment was the activity on 220 MHz. We heard only 21 stations on either SSB, CW or FM all weekend long! One has to wonder if hams really want to keep this band. 432 MHz levels were strong, with 46 stations worked—903 yielded 7 contacts and 1296 brought in 16 additional stations. All in all, a reasonably satisfactory contest!

MAILBOX DEPT.: Harry Schools, KA3B has often been called "Six Meters," and not without due cause! Harry is the author of the *North American 50-MHz Directory* (mentioned here a few months back) and is quite active on the band. In fact, Harry reported working about a dozen stations from Great Britain during the CQ VHF WPX at his Delaware contest location, right while we were off the air trying to fix our rotor and GaAsFET problems! It figures. In any event, Harry is presently gathering material on a book about 6 meters which will cover all aspects of operation on the band.

Harry is looking for photographs of station operations, mobile operations, and any pictures of beacon stations and DXpeditions. He is also in need of old 6 meter newsletters, bulletins and other printed material from the past including promotional literature for equipment. If readers have any of this paraphernalia and would like to send it along for possible inclusion, please contact Harry at

1600 South Newkirk Street,
Philadelphia PA 19145.

TS-711A Q&A

L. Brian Snyder WA8MZQ writes in from Bellefontaine, Ohio, to make several inquiries about my review of the Kenwood TS-711A in April, *73 Magazine*. He had been active on 2 meters with a vacuum tube transverter, 4CX250B amplifier, FET converter, and home-brew 13 long boom yagi back from 1986 till about 1976. I'll try to answer his questions one at a time:

Q: In the paragraph on the receiver's sensitivity, you mentioned the sensitivity was not on a par with "many of the state-of-the-art transverters." Which transverters are you referring to?

A: I am specifically referring to the Microwave Modules units, including the older MMT144-28 and the newer MMT144-28R. SSB Electronics also makes a unit with similar performance.

Q: In this same paragraph, you mentioned you switched in an external GaAsFET preamp to pull out a weak SSB signal. I am curious whether your preamp was mast-mounted or in the shack?

A: This particular preamp was part of a Microwave Modules MML144-200S power amplifier and was in the shack. I personally have never found the need for a mast-mounted preamp on 2 meters and feel that using lower loss feedline is a more practical improvement—plus it saves a lot of GaAsFET devices from lightning strikes and static discharge!

Q: You recommended using a preamp with this unit, but it shouldn't have any more than 10–12 dB gain. All of the preamps that I have seen have much more gain than this. Which preamps or manufacturers do you suggest?

A: That's true—most preamps on the market do have much more gain than 10–12 dB. What I'm stressing with that number is that dynamic range performance of both the preamp and receiver tend to be degraded with gain figures over 15–16 dB unless an external 50 Ohm pad is employed between the preamp and the receiver—in this case, the TS711A. The Advanced Receiver Research preamps are about the best bet for high performance in this regard as they have a very high third order intercept point.

Q: I am very interested in the system you used to key a linear amplifier. Please send any information you can on this.

A: Nothing fancy here! Either I key the amplifier directly from a multimode transceiver (such as the IC271/275 series radios) or use a sequencer, also made by Advanced Receiver Research. The model is #TRS004VD and it will key up to four external items such as a preamp, relays, amplifier and transverter/transceiver. A foot switch can be used to sequence the whole thing.

A source for the Microwave Modules equipment is The PX Shack, 52 Stonewyck Drive, Belle Mead NJ 08502. ARR products are available from Advanced Receiver Research, PO Box 1242, Burlington CT 06013. Hope this helps!

The recent issue of the EME Newsletter includes information that Gene Shea, KB7Q will no longer be manufacturing the "Q" Products amplifier kits. Too bad, for they represented a great deal for the money! Gene says that time constraints have limited his ability to manufacture these units and is looking for a buyer to clean out his inventory (and customer list!). If interested, contact Gene at 417 Staudaher Street, Bozeman MT 59715 (406) 587-9150.

Up And Coming

I am in the process of reviewing the new IC-900 multiband system with the 2-meter band unit, which has to be one of the strangest looking setups I've ever used. Figure 1 shows what the component parts look like (although I don't recommend setting it up like that!) and after all is done, you've got a 25-Watt FM rig on 2 meters—all for $800. I can hardly see spending that much for one band, but you can completely conceal the various modules in your car and control everything from the small unit in front.

Also coming along is a review of the IC-475A 70-cm multimode, which I've now had a chance to use pretty extensively in the ARRL and CQ VHF contests. It's impressive indeed! ICOM is definitely onto something with these "75" radios as far as performance of the receiver goes. Look for this review next month along with the IC-900 and the ICOM AG35S/AG1200S mast-mounted preamplifiers.

Speaking of which, ICOM was generous enough to donate another IC-1271A for our Chincoteague effort which we also used again during the CQ WPX. As I mentioned in my review last year, the 1271A really needs some sort of preamp in front of it, and the AG1200S makes all the difference in the world. It's neat having a complete 23 cm station all by itself in one package. One drawback: The AG1200S is only rated for 15 Watts maximum power capacity in a mast-mounted application! In my case, that meant running the preamp right behind the 1271A and before the outboard 23 cm cavity amplifier (elsewhere in this issue). The feedline used on Chincoteague was 9913; however, we employed two stacked 55-element yagis which had more than enough gain to overcome the losses of the feedline. One useful accessory I whipped up was a box with two RCA jacks on it and a 24-pin MOLEX plug. This connected to the +13.8 VDC line and the keying line from pin 8 of the 1271A connector. These two lines were used to provide a PTT closure to ground (to activate bias for the amplifier) and 13.8 VDC for the coaxial relay on the external amplifier. Very handy!

I also had to make similar cables up for the IC-275A and IC-475A we used. Surprise! No more 24-pin MOLEX connectors! ICOM has now gone to an 8-pin DIN connector, same as that used on the Kenwood TS-520/530/430/440/930/940 radios! This connection allows keying of the amplifier through pin 3 of the DIN plug, and our external Microwave Modules and Tokyo Hy-Power linears keyed with no problems for the duration of both events.

With the external amplifier and preamp, the 1271A is probably worth the money if you are seriously interested in 23 cm work. Consider that the only comparable 23 cm product (the SSB Electronics LT23S transverter) will set you back over $600, and the 1271A begins to look attractive. Of course, you don't have to use the AG1200S and in fact might be better off installing your own preamp inside the radio permanently. There's plenty of room for it! Both SSB and Microwave Components of Michigan make excellent 23 cm GaAsFET preamps for about $100 or so.

Well, that's it for this month; see you the next. Above and Beyond! ■

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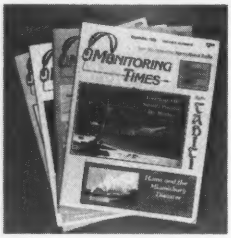

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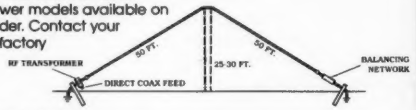

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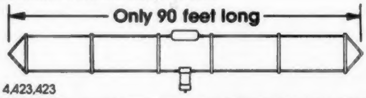

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CIRCLE 53 ON READER SERVICE CARD

AERIAL VIEW

Arliss Thompson W7XU
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Do you build your own antennas? Or are you like the ham I recently overheard on one of the local repeaters who said that the only antenna he had ever erected was the rubber duck on his HT? If that could have been you, let me assure you that it is easy to build simple, yet efficient, wire antennas and have fun doing it. Besides that, you'll save money—and who doesn't want to do that?

What appears to be number one in the simplicity department is the endfed wire (Fig. 1). After all, what could be more simple than attaching one end to the output jack of your transmitter and securing the opposite end to the top of the highest object available? That sounds great in theory, and they can work well in practice, but there are some problems that can arise with random length endfed wires.

Problems? What sort of problems? First of all, the impedance your transmitter "sees" will vary with the length of the wire. If the wire is 1/4-wavelength or a multiple thereof, in length it will have a low impedance at the transmitter, perhaps close enough to 50 Ohms to make your transmitter "happy."

The odds are, however, that you will need some sort of matching device if your transmitter is going to put out full power (many modern transceivers reduce power output in the face of an swr of greater than 2:1). If the antenna is 1/2-wavelength long or some multiple of that length, it will present a high impedance at the transmitter and you will definitely need an external matching device.

Another problem that can arise with the endfed wire is "rf in the shack." You'll know that you have this problem when your rig begins operating erratically and you get zapped if you come into contact with your equipment when the transmitter is keyed. (Talk too close to the mike and you'll get it in the lips.) Proper grounding can cure this problem, but you also can avoid it entirely by using an antenna with low impedance feed, such as a centerfed dipole.

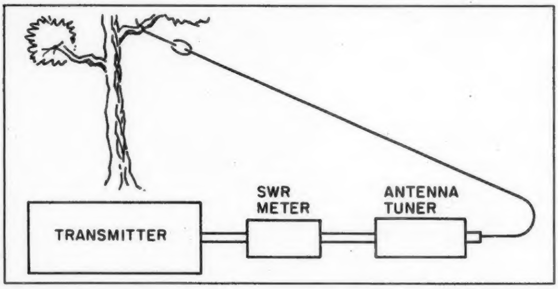
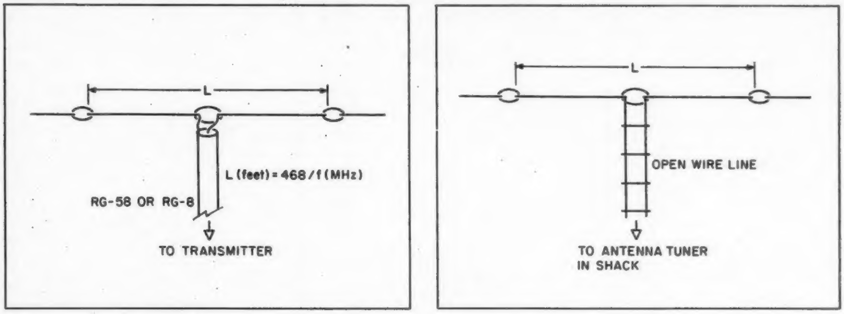
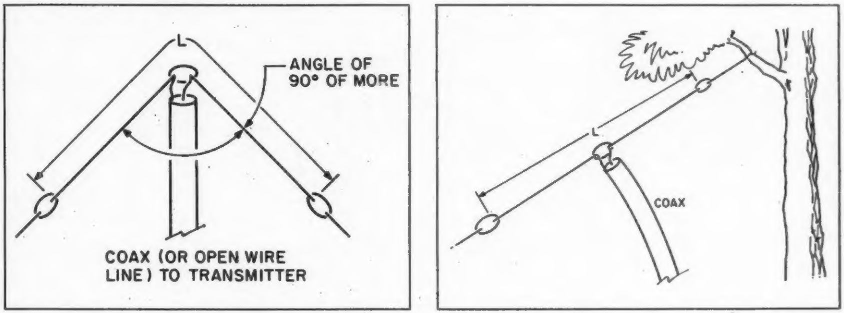


Fig. 1. Endfed wire with swr meter and antenna tuner installed for matching purposes.



(a) A coax-fed dipole. RG-58 is suitable for moderate runs at the lower frequencies. Use RG-8 for long transmission lines, especially at 10 meters.

(b) Dipole fed with open-wire line. An antenna tuner is needed between this transmission line and the transmitter.



(c) Inverted vee. The length at resonance will be approximately 468/f, but will vary with the angle of the vee.

(d)Sloper. As with all of these antennas, try to bring the feedline off at right angles from the antenna.

Fig. 2. A variety of dipole antennas.

When it comes to combining performance and simplicity, it's hard to beat the 1/2-wavelength centerfed dipole. You can feed it directly with coax, if you're interested in operating on a single band, or use open-wire line and a tuner to put the antenna to use on a number of bands (Figs. 2.(a) and 2.(b)). The dipole can be supported from its ends, from its center, thereby forming an inverted vee (Fig. 2 c), or from one end, producing a sloper—Fig. 2.(d). You probably learned that the impedance of a resonant half-wave dipole is 70 Ohms and that the antenna does not radiate off its ends, but when mounted relatively close to the ground the radiation pattern assumes a more omnidirectional shape, and the impedance is typically in the vicinty of 50 Ohms. The latter fact allows us to feed the dipole with common RG-58 or RG-8 coax. A 1:1 balun may be inserted at the antenna feedpoint in this case if you so desire, but you can obtain equal and perhaps superior results without a balun.

A third simple wire antenna is the full-wave loop (Fig. 3). It may be erected in the shape of a square, rectangle, or triangle. Due to space limitations, this antenna is more commonly used on 7 MHz and higher frequencies, where the size of the loop becomes more manageable. To match the impedance of the resonant loop to that of RG-58 or RG-8 coax, it is necessay to insert a 1/4-wave transformer formed from 75-Ohm coax (RG-59, for example); see Fig. 3. At right angles to the loop this antenna theoretically has a gain of about 2 dB over a dipole, but if mounted close to the ground (in terms of wavelength) I doubt that the full 2 dB will be realized.

Perhaps you would like to put up a dipole on 80 but, living on a small city lot, feel there isn't sufficient room. Well, there are ways around that. If necessary, you can bend the ends of the dipole to conform to the available space. Another solution is to use a shorter antenna. After all, a dipole does not necessarily have to be 1/2-wavelength long. The efficiency of, say, a 75-foot dipole on 80 meters will be only slightly less than that of a full-sized antenna. To use such an antenna, however, you will need to feed it with open-wire

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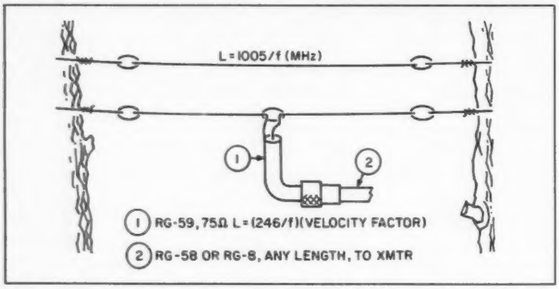
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①
②
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Fig. 3. Full-wave loop. The length of the 75-Ohm matching section is given by the formula above. The velocity factor varies with the type of coax. It is 0.66 for solid dielectric and 0.8 for the foam type.

line with a transmitter to provide a match to your rig's 50-Ohm output. As was mentioned earlier, this antenna could be used on all the HF bands.

Worried that you can't get that antenna more than 15 feet above the ground? Well, it's generally true that the higher the antenna the better your results will be, but that doesn't mean that an antenna in close proximity to the ground won't work at all. You may not be the strongest signal on the band, but you will still be able to make contacts. Do take care, however, to keep your antenna out of reach of passers-by to avoid possible rf burns.

"Okay [you say], you've convinced me. But what kind of wire should I use, and what do I do for insulators?" Any of the antennas described here can be built of solid or stranded wire, insulated or bare. The National Electric Code states that all antennas should be constructed of at least No. 14 wire, but it is fair to say that most hams use whatever is handy, so long as it will support itself. As for insulators, you can buy them or make your own. Suitable materials include Plexiglas™ and a variety of plastic materials. Parachute cord or similar light rope is good for supporting the ends of your antenna: be aware that plastic-type ropes disintegrate in a relatively short time when exposed to sunlight.

When feeding an antenna with coax, I like to use a small piece of Plexiglas as a center insulator, with a female coax connector (SO-239) mounted right on the Plexiglas (fig. 4). This makes it a simple matter to connect your feedline or to remove it later, if necessary. Be sure to waterproof the connection with Coax-Seal or a similar product to keep water from invading the line and ruining the coax.

If you want to use open-wire feedline, you will probably have to construct your own, but that is not a difficult task. Once again, small strips of Plexiglas are suitable for insulators. You can also use things like hair curlers, or other household items that are nonconductors. Their length is not critical, but try to keep the spacing of the wires relatively constant (3 to 6 inches). Try to keep this line at least 6 inches away from other wires or surfaces. It can be somewhat awkward to bring such a line into the shack. One way to do so is to secure the end of the line near the shack, and run a short length of 300-Ohm twinlead between your tuner and the main transmission line. This will probably result in an swr "bump" on the transmission line, but since the line is a low loss type this should create no problems. Any reflected power will be re-reflected by the antenna tuner, travel back up the transmission line, and be radiated by the antenna.

As I mentioned earlier, a dipole fed with open-wire line may be used on several bands with the aid of a tuner. If you want to avoid the hassle of open-wire line and an antenna tuner, but want to operate on more than one band, there are a couple of options available to you. One is to make separate dipoles with separate transmission lines for each band. Or you can use one coax feedline with the dipoles connected in parallel (Fig. 5). Using the latter method will probably result in a narrower bandwidth between 2:1 swr points, but it will allow you to get on two or more bands with a single coax feedline.

So there you have some simple wire antennas that are not difficult to build, and provide good performance. Why not give one a try?■

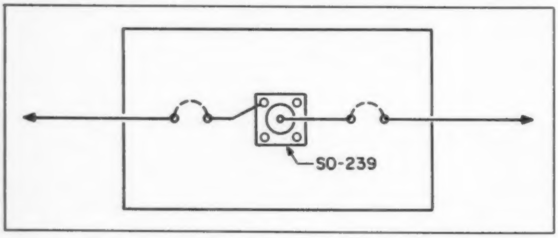

Fig. 4. Center insulator for dipole constructed from Plexiglastm sheet and female coax connector. The antenna wires are woven through holes in the Plexiglas to relieve strain on the SO-239 connections.

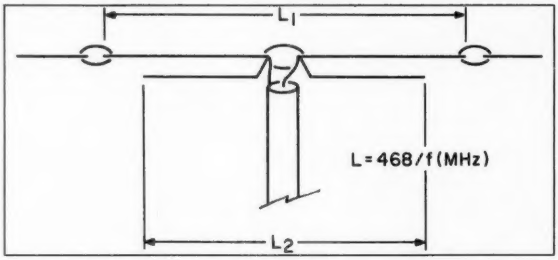

Fig. 5. Parallel dipoles. The dipoles are initially cut to length using the formula shown, then trimmed to achieve resonance. There is some interaction between the two dipoles, so recheck the resonance points after trimming the second dipole.

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CONSTITUTIONAL COMMENTS

In my recent columns I have spoken much about the need for the official formation of clubs or organized ATV Groups to accomplish and finance a difficult task: To get an ATV repeater and/or remote transmitter on the air and operating. It is certainly a difficult task for one or two devoted individuals to complete but many systems have been built up just that way—without much help at the beginning. You have to do what must be done to get ATV activity going in your local area. Hopefully, you'll have some friends to help share the load. ATV clubs have the mode to keep interest alive and everyone together!

I spoke also about the importance of a good, well-written club constitution and its by-laws that specializes in the fast- scan TV mode of operation. More general club constitutions are fine for regular amateur radio clubs but some specific changes are required for specialized groups.

I would be happy to send a 4-page copy of our local group's constitution and by-laws for an SASE. It might be an invaluable aid in setting up your own legislation document. We got our example copy from the Southern California ATV Group.

DTMF Circuits

In our area, we have N9CAI ATV/R, perhaps the most complicated FSTV UHF 10-channel ATV remote transmitter in the country. This is now linked via 910.25 MHz (WB0BIZ ATV/R) for ten additional channels—totalling 20 viewable TV video source feeds. The new linked TV channel feeds are for:*color weather radar* at 60-, 120-, 180-, and 240-mile scans; the GOES EAST/WEST Satellites; an outdoor 200-foot, weatherproofed, rotatable, pan and tilt, color CCD tower camera overlooking the Quad-City Mississippi River Valley; a wall- mounted color NBC studio camera that lets us see pre-setup and takedown of live local channel 6 newscasts; a satellite A-NEWS feed; various internal studio-to-on-site area engineering microwave TV feeds; an auxiliary ATV #2 receiver on 439.25 MHz.; a computerized spectrum analyzer program display interfaced to 2m FM; a packet radio digipeater video window feed; and a local NBC off-air tap. There are a couple of other expansion channels to be used for future uses.

The above part of our system was built by WB0BIZ. The majority of use of our local ATV system is in what we call Mode-A; the remote transmit (RT) position. There are few RT systems across the country, but interest is growing and we are beginning to see more additions of the above-mentioned touchtone™ select capability feature to ATV repeater systems. There are 17 such systems known in the country. They are really much simpler to construct compared to the effort required to make an inband wideband video repeater work.

Surprisingly, the heart of any ATV RT lies in a non-video module: the touchtone™ decoder circuit. This circuit controls the on/off keying of the fast scan TV transmitter and does the switching for all the video source feeds. You can build or buy these devices. Radio Shack has a nifty SS120P IC DTMF decoder (Cat. #276-1303) for $8. Figure 1 is a simple circuit, like the one provided by John Hegeman WB0BIZ of Davenport (our 910-MHz link T.T. control system). A number of other similar DTMF designs have been in nearly all electronics journals.

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W3POS and K0/IWA set new FSTV DX land record of 570 miles. (Photos by WB8ELK)

Other more multi-functioned DTMF circuits popular for the radio hobbyist are ones from Advanced Computer Controls, Inc.[1] Their ITC-32 model has 28 outputs, onboard sense alarms, and command acknowledgments done in CW. This unit runs about $275. Connect Systems, Inc.[2] has a neat model; the CS-16 ($164), with 16 functions and two passwords. These and other more expensive DTMF circuits are designed more for the elaborate controlling of voice repeater systems rather than the simple switching of video source feeds for ATV. If you want to turn on/off only one video source, such as a computerized bulletin board, weather radar, or camera, investigate the Engineering Consulting[3] model TSD kit, a 4-digit DTMF for just $23 ($60 assembled). Yes, you can order and add on extra latches for just $9 each!

The *Spec-Com Journal*[4] (September/October 1986) published a construction article by WA8HEB on a MOSTEK MK5102 decoder that uses a S3525A filter (contact WB0ESF and include $2.50 for the issue). Just browsing through the amateur radio journals, one can find all kinds of DTMF decoder circuits to fit the needs of an ATV building project. Also keep in mind, that such a project can be done at home station as well as out on an ATV/R site. Hmmm. . . the possibilities!

The built-up and interfaced decoder circuit has the purpose to switch the video sources. These 75-Ohm (hopefully terminated on all unused ports) video feeds do not hook up directly to the DTMF board. You must have a switching video channel sequencer or selector. These can be found at any hamfest and/or broadcast TV station. Most are rack-mounted, although some are housed in small boxed compartments with the inside mechanical DC voltage relays with BNC, RCA, or S0-239 female connectors. The mechanical video selector box or panel must work in unison with the DTMF decorder. John Gebuhr WB0CMC of the Omaha Nebraska ATV group has some well-drawn plans for making up such a device. In fact, at Dayton he asked me if I thought there would be any interest or market for a rack-mounted panel with switches, connectors, and even a touchtone™ circuit. Contact John by mail and twist his arm a little, and I'll bet he'll come through for you non-builders. Hap Griffin WA4UMU or Gerald Cromer K4NHN of Cayce, South Carolina might also have some suggestions. Once these two devices are procured and interfaced, you need only hook up a transmitter and video source feeds.

What ATV Transmitter to Buy?

I recommend either the PC Electronics (see ad in *73*) KPA5 (70cm at $159) or KPA-33 (900 MHz) 1-Watt exciter, or their TXA5 and 10-Watt PA systems. For a catalog of their fine ATV products, write to them directly at 2522 S. Paxson, Arcadia CA 91006. Wyman Research (RR #1, PO Box 95, Waldron IN 46182) also has some neat little 1-Watt exciters and 10-Watt systems for about the same price. Also available is the PC KPA5 pre-assembled circuit board housed in an rf-proof Hammond Box with power, input, and output connectors used on the Chicago 1-Watt KB9FO ATV remote transmitter system at the Merchandise Mart. It can't get much simpler! Low-power 1-Watt transmitters can be power-boosted to 10, 20, or 50 Watts by Alicon or Mirage amplifiers. The touchtone™ decoder can also select high or low power levels as desired by the user operator.

All incoming video sources should have their varying composite video, colorburst, and sync levels passed through what are called video distribution amplifiers. These amps assure uniform TV signals. Don't let not having one of these amps hold you up from getting on the air. However, varying sources are not critical, and many sources can be adjusted internally for quite acceptable pictures. Hap Griffin WA4UMU offers Proc-Amps and distribution amplifier kits for ATVers.

What kind of TV video channel feeds can you put on such a system? We have talked about this before in previous columns so I will just reiterate the list: computer bulletin boards, NTSC color bars, live cameras, radio station disk jockeys, ATV/R windows, SSTV converters, commercial gameboards, VCR players, weather radar and other satellite feeds, spectrum analyzers, video-modified scopes, packet, Fax, RTTY, and Morse converters. In short, whatever is video can be used as a viewable source! The only thing to be careful of is to ensure that

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each feed serves a useful purpose. For an elaborate RT block diagram of a system, including linked sources, send me an SASE referring to this subject.

In Praise of Remote Transmitters

ATV remote controlled transmitters are catching on. They provide an alternative mode selector to an ATV repeater system. This gives a closed access capability to a system. (This is a good way to ensure membership dues payment!) Here in SE Iowa, Mode-A our remote transmitter, gets used much more than our Mode-B FSTV repeater. There is no need to be alarmed about deteriorating live video viewing. After our RT was activated, over 25 members joined our BRATS ATV Club and eventually got on two-way FSTV, due largely to the neat things being shown at night on Mode-A! Remote transmitters can be a real boost for UHF Ham-TV activity! Standards have to be established on how to properly access, run, and shut down the system.

Nearly all in our group FCC ID before and after accessing the system, or it gets shut down on them quickly. Dues are kept up to date since no one wants to lose the touchtone™ control operating privileges. On ATV, once you get hooked, it's hard to back out! ATV remote transmitters quickly become your reliable friend out there. They are always there to serve and entertain you. Now go out there and build one! If you do, register it with the USATVS. 73s de Mike WB0QCD See you on the tube next month . . . ■

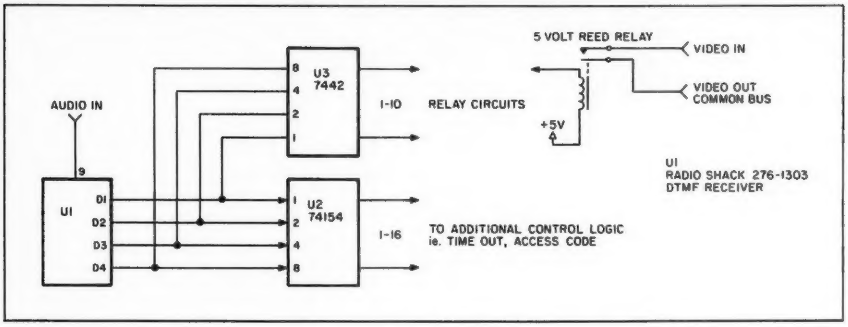

Fig. 1.

References

1. Advance Computer Controls, Inc., 2356 Walsh Ave., Santa Clara CA 95051.
2. Connect Systems, Inc., 23731 Madison Street, Torrance CA 90505.
3. Engineering Consulting, 583 Candlewood Street, Brea CA 92621.
4. Ralph Wilson WB0ESF, Copy Service, 4011 Clearview Drive, Waterloo IA 50613.

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
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OK, Okay, OKAY! I hear you all clamoring to get your two-cents' worth into the column after my monopolization for the last few months. Just cool your jets, and I'll try to take you one at a time!

Just to whet your appetites, folks, the topics we will cover this month should range from antique to modern, with just about everything in between. Let's dig into the mail pouch and see what we find.

Art Simpler K4LJX, from Lake City, Florida, writes: "down here in the south, it is impossible to get parts for my transmitter, such as mica condensers. I have a WRL (that's World Radio Labs to you youngsters) 500-Watter and have need for parts from time to time, and I'm wondering if there's an electronics store that may have the above."

Well, Art, I remember WRL—used to have a catalog with their equipment when I started in this hobby almost a quarter of a century ago (I was an infant... ha!). Other than the few old caps I have in the junque box, I know of no current source for such parts. Anybody lend a hand? Such information is always useful, what with old transmitters and receivers changing hands at hamfests and club swapmeets. Pass the details along, and I'll try to circulate it here for all to benefit.

Jumping over to the RTTY1-1 program a bit, that is the one featured in the July issue of this column, for the Radio Shack Color Computer®, Raymond Cervantes III of Garland, Texas, wonders about using this program with tape, and whether or not there are any hidden commands. Well, Raymond, if there are any hidden commands, they are hidden well enough that I don't know about them. Although the program is set up to load from disk, it does support tape saves and loads of data, and in this way supports tape. It does not, to my knowledge, run directly on a tape-based (only) CoCo, as it accesses various subroutines in the disk ROM. Now, someone may have it running on a tape-only machine, and if I hear about that, I'll pass it on. In the meantime, though, I'd say this may not be the best choice for a tape-only system. There is more in the wings, though, so keep reading the column this winter!

More Mail

Not all my mail is complimentary, folks. Here's a letter from Larry Morgan, K7LX of College Place, Washington, that takes issue with the review of the AEA PK-232. Larry writes:

"I am saddened and upset to see a whole column, nearly two magazine pages, devoted to a recitation of the AEA PK-232 features—written much like advertising copy...

"It is bad enough that equipment reviews are often written in this manner, but I would hope the news columns could be written in a more straightforward and balanced manner. For instance, nowhere in this column do you mention a fact about the PK-232 that should be of major interest to anyone operating RTTY: the 200- (rather than 170-) Hz shift is employed both on transmit and receive.

"The great majority of the information in this column could and should be obtained by interested persons from the manufacturer, not from a magazine news column.

"And, incidentally, you mention lack of expressed interest in AMTOR for your lack of coverage in your column. May I suggest a clearer indication of interest might be gained by listening on the air? Try tuning 14070 to 14080 any time 20 meters is open and you will find plenty of activity.

"Your column does not make clear if you actually *own* a PK-232, but if you do you might be interested in a PK-232 characteristic I discovered while operating the unit for several months on AMTOR: When in ARQ AMTOR QSO with a station with a better than average signal, the PK-232 was showing numerous errors on both ends of the circuit (that is, repeat requests) and very slow throughput. After about 40 minutes of this, the other station mentioned in pass-

RADIOFACSIMILE SCHEDULE

CFH	HALIFAX NS, CANADA	4271, 6330, 10536, 13510
GXH	THURSO, SCOTLAND	3731,8080, 12865
NAM	NORFOLK VA, USA	3357, 8080, 12865
WLO	MOBILE AL, USA	6850, 9157.5, 11145
NMF	BOSTON MASS, USA	3242, 3242.5
WFH/WFK	BRENTWOOD NY, USA	9290, 9389.5, 11035
	HONOLULU HI, USA	9982.5, 11090, 16135, 23331.5
NMC	S.F. CA, USA	4346, 8682, 12730, 17151.2
CKN	ESQUIMALT B.C.,CAN.	4268, 6946, 12125
NOJ	KODIAK AK, USA	4298, 8459
NPM	PEARL HARBOR HI, USA	2122, 4855, 8494, 9396, 14826, 21837
WWD	LA JOLLA CA, USA	8644.1, 17408.6

North Atlantic Ocean

TIME (Z)	AREA	SOURCE
0000	WESTERN NORTH ATLANTIC (ICE INFO)	CFH
0115	NORTH ATLANTIC OCEAN(SCHEDULE)	NAM
0115	WESTERN MED/EASTERN ATLANTIC (SCHED)	GXH
0250	GULF OF MEX (ANALYSIS)	WLO
0300	GULF OF MEX (WIND AND WEATHER ANALYSIS)	WLO
0310	GULF OF MEX (FORECST)	WLO
0316	WEST. NOR. ATLANTIC (ANALYSIS)	CFH
0416	W. NOR. ATL. (WAVE ANALYSIS & PROGNOSIS)	CFH
0500	WEST. NOR. ATLANTIC (ANALYSIS)	CFH
0520	W. NOR. ATL. (36 HR SURFACE PROGNOSIS)	CFH
0530	NEW ENGLAND WATERS (ANALYSIS)	NMF
0540	NEW ENG. WAT. (12 HR SURFACE PROGNOSIS)	NMF
0550	NEW ENG. WAT. (36 HR SURFACE PROGNOSIS)	NMF
0600	NEW ENG. WAT. (SURFACE PROGNOSIS)	NMF
0600	WEST. NOR. ATLANTIC (SURFACE PROGNOSIS)	CFH
0616	W. N. ATLANTIC (24/36 HR WAVE PROGNOSIS)	CFH
0700	W. N. ATLANTIC (ANALYSIS)	CFH
0708	W. N. ATLANTIC (NEPHANALYSIS)	CFH
0750	W. N. ATLANTIC (ANALYSIS)	WF/WFK
0800	W. N. ATL. (SEA SURF. TEMP. ANALYSIS)	CFH
0850	GULF OF MEXICO (ANALYSIS)	WLO

North Pacific East

0001	40 N,25 S; 110 W, 160 E	KVM70
0015	SAME (ANALYSIS)	KVM70
0030	SAME	KVM70
0046	SAME (NEPHANALYSIS)	KVM70
0100	20 S-30 N,EAST OF 160 W (SURFACE PROGNOSIS)	NMC
0100	40 N,EQUATOR;110W;160E (WAVE PROGNOSIS)	KVM70
0103	30N-60N,EAST OF 160E (SEA SURF. PROGN.)	NMC
0113	SAME AS ABOVE	NMC
0123	SAME (EXPERIMENTAL)	NMC
0300	63N,179E,37N,160W,34N,118W,55N,92W (TEST CHART)	CKN
0300	30N-60N, EAST OF 160E	NMC
0303	40N-52N,EAST OF 135W (SEA SURFACE TEMP ANALYSIS)	NMC
0310	SCHEDULE	CKN
0313	28N-40N,EAST OF 136W (SEA SURF. TEMP ANALYSIS)	NMC
0325	46N,177W,28N,157W,37N,122W,63N,121W (ANALYSIS)	CKN
0333	28N-40N,EAST OF 136W (SEA SURF TEMP ANALYSIS)	NMC
0335	59N,155W,35N,140W,37N,122W,63N,121W	CKN
0340	63N,179E,37N,160W,34N,118W,55N,92W (ANALYSIS)	CKN
0500	GULF OF ALASKA AND BERING SEA	NOJ
0500	30N-60N,EAST OF 160E	NMC
0503	SAME (ANALYSIS)	NMC
0513	SAME	NMC
0523	SAME (EXPERIMENTAL)	NMC
0540	TEST CHART	KVM70
0547	30N,50S,90W,180	KVM70
0601	40N,25S,110W,160E	KVM70
0615	SAME (ANALYSIS)	KVM70
0630	SAME	KVM70
0646	SAME (NEPHANALYSIS)	KVM70
1000	GULF OF ALASKA AND BERING SEA	NOJ
1105	TEST CHART	KVM70
1117	30N,50S,90W,180 (ANALYSIS)	KVM70
1131	40N,25S,110W,160E (ANALYSIS)	KVM70
1145	40N,25S,110W,160E	KVM70
1200	SAME	KVM70
1200	SCHEDULE (60N-05N,123W-161W)	NPM
1214	SCHEDULE (60N-05N, 165E-101W)	NPM
1216	40N,25S,110W,160E (NEPHANALYSIS)	KVM70
1228	60N-05N,123E-161W (24 HR SURFACE PROGNOSIS)	NPM
1230	40N, EQUATOR; 110W; 160E	KVM70
1242	60N-05N, 165W-101W (SCHEDULE)	NPM
1256	60N-05N,123E-161W (24 HR SURFACE PROGNOSIS)	NPM
1310	60N-05N,165W-101W (24 HR SURFACE PROGNOSIS)	NPM
1324	SAME AS 1256Z	NPM
1338	SAME AS 1310Z	NPM
1352	SAME AS 1256Z	NPM
1406	SAME AS 1310Z	NPM
1420	SAME AS 1256Z	NPM

1434	SAME AS 1310Z	NPM
1448	SAME AS 1256Z(48 HOUR)	NPM
1500	40N-52N, EAST OF 135W (SEA SURF. TEMP ANALYSIS)	NMC
1500	TEST CHART	CKN
1502	SAME AS 1310Z(48 HOUR)	NPM
1503	30N-60N, EAST OF 160E (MEAN MIXED LAYER DEPTH ANALYSIS)	NMC
1510	63N,179E,37N,160W,34N,118W,55N,092W (SURFACE PROGNOSIS)	CKN
1513	28N-40N, EAST OF 136W (EXPERIMENTAL)	NMC
1516	60N-05N, 123E-161W (48 HOUR ANALYSIS)	NPM
1523	30N-60N, EAST OF 160E (EXPERIMENTAL)	NMC
1525	SAME AS 1510Z	CKN
1530	SAME AS 1310Z (48 HOUR	NPM
1530	SAME AS 1510Z (12 HOUR)	CKN
1540	SAME AS 0325Z (WAVE PROGNOSIS)	CKN
1544	SAME AS 1256Z	NPM
1550	SAME AS 1540Z	CKN
1600	SAME AS 1530Z (ANALYSIS)	CKN
1608	NORTH PACIFIC OCEAN	NPM
1615	SAME AS 1550Z (SEA SURF TEMP ANALYSIS)	CKN
1627	NORTH PACIFIC OCEAN	NPM
1644	NORTH PACIFIC OCEAN	NPM
1648	SAME AS 1544Z (72 HOUR)	NPM
1700	20S, 30N; EAST OF 160W (ANALYSIS)	WWD
1702	60N-05N,165W-101W (72 HR SURFACE PROGNOSIS)	NPM
1715	20S-30N,EAST OF 160W (SEA SURF TEMP ANALYSIS)	NMC
1716	58N-10N,177W-110W (ANALYSIS)	NPM
1718	SAME AS 1700Z	NMC
1728	30N-60N, EAST OF 160E (12 HR ANALYSIS)	NMC
1738	20S-30N, EAST OF 160W	NMC
1738	58N-05N,120E-173W (ANALYSIS)	NPM
1755	TEST CHART	KVM70
1802	30N,50S;90W;180	KVM70
1814	NORTH PACIFIC OCEAN (WARNINGS)	NPM
1816	40N, 25S; 110W, 160E (ANALYSIS)	KVM70
1830		KVM70
1830	60N-05N, 123E-161W (SEA SURF TEMP ANALYSIS)	NPM
1844	60N-05N, 165W-101W (SEA SURF TEMP ANALYSIS)	NPM
1846	60N, 10S; 115W, 160E (ANALYSIS)	KVM70
1858	60N-05N, 123E-161W (12 HR SURFACE PROGNOSIS)	NPM
1900	EXPERIMENTAL	WWD
1900	GULF OF ALASKA AND BERING SEA	NOJ
1900	60N-10S, 115W-155E (ANALYSIS)	KVM70
1903	40N, 25S; 110W, 160E (NEPHANALYSIS)	KVM70
1912	60N- 05N, 165W- 101W (12 HR SURFACE PROGNOSIS)	NPM
1917	60N, 34S; 110W, 98E (SEA SURF TEMP ANALYSIS)	KVM70
1926	60N-05N, 123E-161W (12 HR SURFACE PROGNOSIS)	NPM
1940	SAME AS 1912Z	NPM
1954	60N- 10N, 160E- 90W (ANALYSIS)	NPM
2000	20S -30N, EAST OF 160W	NMC
2003	SAME AREA (SCHEDULE)	NMC
2013	30N-60N, EAST OF 160E	NMC
2019	SAME AS 1926Z (36 HOUR)	NPM
2023	SAME AS 2013Z	NMC
2033	SAME AS 1940Z (36 HOUR)	NPM
2047	SAME AS 2019Z (12 HOUR)	NPM
2100	TEST CHART	CKN
2101	SAME AS 1912Z	NPM
2110	SAME AS 1530Z	CKN
2115	60N-05N, 123E-161W (ANALYSIS)	NPM
2125	SAME AS 2110Z	CKN
2129	SAME AS 2101Z (36 HOUR)	NPM
2140	SAME AS 2125Z (ANALYSIS)	CKN
2143	60N-05N, 165W-101W (ANALYSIS)(36 HOURS)	NPM
2150	SAME AS 2140Z	CKN
2157	SAME AS 1926Z (36 HOUR)	NPM
2200	GULF OF ALASKA AND BERING SEA	NOJ
2205	59N,155W,35N,140W,37N,122W,63N,121W(WTHR DEPIC.PROG.)	CKN
2210	46N,177W,28N,157W,37N,122W,63N,121W (WAVE PROGNOSIS)	CKN
2211	60N-13S,115E-105W (24 HR SURFACE PROGNOSIS)	NPM
2220	SAME AS 2210Z	CKN
2234	SAME AS 2157Z	NPM
2248	SAME AS 2101Z (26 HOURS)	NPM
2300	20S,30N, EAST OF 160W (ANALYSIS)	WWD
2302	58N-10N,177W-110W (ANALYSIS)	NPM
2315	25S-40N,160E-110W (TEST CHART)	KVM70
2324	58N-05N,120E-173W (ANALYSIS)	NPM
2330	20S-30N,EAST OF 160W	NMC
2333	SAME	NMC
2335	TEST CHART	KVM70
2343	30N-60N,EAST OF 160E (18 HR ANALYSIS)	NMC
2346	NORTH PACIFIC OCEAN	NPM
2347	30N, 50S; 90W; 180	KVM70
2347	SCHEDULE	KVM70
2353	EXPERIMENTAL	NMC

ing that ANOTHER party he talked to regularly that used a PK-232, found under similar conditions that resetting the PK-232 by turning it off and back on again would often clear up the circuit. I tried that right while we were talking and immediately the throughput jumped up to near 100 percent, as befitted the good signals we had. After repeating this experience several times I just developed the habit of resetting the PK-232 (by turning it off and right back on) every few minutes. I can only assume this is a software problem that takes some particular unknown set of circumstances to manifest itself. It is really insidious since the unit doesn't stop working completely, which you would of course notice immediately. It just slows down the throughput more than it should."

Larry, you raise several points, which is why I am printing essentially your entire letter. To begin with, the August column was written by me, not by AEA or some advertising copywriter. If you don't like my choice of words, I'm sorry, but we all choose the form in which we would like to get a message across.

A few years ago I devoted a column to AMTOR, going over the basic techniques and differentiating some of the modes. I even printed a bit of correspondence with Peter Martinez G3PLX, whose introduction to AMTOR in the PK-232 manual I specifically highlighted. The fact is, that until this piece on the PK-232, I averaged less than one letter a *year* on AMTOR. Thus my statement of no interest. If this article, and others like it, lead to more coverage of this mode, it will be my pleasure to be there with material.

Yes, I do own a PK-232, and within the limits of use I put it to I was quite impressed. The problem you describe is interesting for two reasons: to circulate, so that other owners of PK-232s can look at their own situation and report their findings; and to report to AEA so that, if it still exists in the latest ROM, it can be fixed. For your information, as well as other PK-232 owners, the ROM release I have, 04.MAR.87, is, I believe, the latest one. This is the ROM that includes FAX and SIAM modes.

I will report back to you what AEA has to say. I really do thank you, Larry, for your letter. It is only through interested readers like yourself that I can keep a sense of what all want to see here in RTTY Loop.

Helpful Hints

Howard S. Bacon of South Pittsburg, Tennessee, is a CoCo nut who must have read one of last month's books because he relates that he is working on his Digital Novice. Good luck, and keep reading for more along the same and other lines!

One fellow looking for help is E. Oskar Schreiber, M.D. KE5ZV, of Harlingen, Texas, who is running a TRS-80® Model III on RTTY. Although he, too, is using a PK-232 interface, he is looking in vain for a good terminal program. Well, Oskar, a few years back there was a program for the TRS-80 Models I, III, and IV, put out by KCQ Software, about which I received many favorable comments. You might drop a note to Clifton Turner, Jr. WB5KCQ, 6319 Boef Trace, Alexandria LA 71301, and ask for more information. Don't forget to plug us, here, OK?

FAX appears to be one topic which, along with copying press RTTY, anyone with the capability of copying likes to keep around to impress visiting civilians. Paul Cournoyer N2FPB, of Ballston Spa NY, is one of those folks who is using a CoCo and the public domain WEFAX program to copy pictures. He finds good copy on 18.431 MHz from 5 p.m. to 9 p.m. EST, and notes another signal on 10.330 MHz at around 8 p.m. EST.

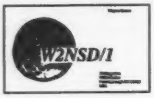
Another list that has come into the shack is printed in Figure 1. Here is one ham's compendium of all kinds of FAX information. Have fun, folks!

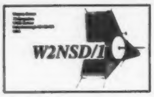
Next month will find more of your questions and topics. On tap for future months is yet another CoCo RTTY program, which combines some of the best features of all those yet published, as well as material for several other systems. Don't forget to direct your questions to me either by mail or electronically on CompuServe (75036,2501) or Delphi (MARCWA3AJR), with mailed questions accompanied by a self-addressed, stamped envelope if you desire a personal reply. Let me hear from you! It is your input that makes this column what it is.■

UNCLE WAYNE'S

BOOK SHELVES

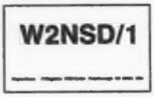
Style W

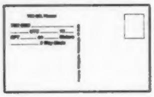




Style X

Style Y





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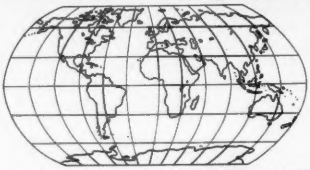

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"The Stickler"

6+ wpm-This is the practice tape for those who survived the 5 wpm tape, and it's also the tape for the Novice and Technician licenses. It is comprised of one solid hour of code. Characters are sent at 13 wpm and spaced at 5 wpm. Code groups are entirely random characters sent in groups of five—definitely not memorizable!

"Back Breaker"

13+ wpm-Code groups again, at a brisk 13+ wpm so you'll be really at ease when you sit down in front of a steely-eyed volunteer examiner who starts sending you plain language at only 13 per. You'll need this extra margin to overcome the sheer panic universal in most test situations. You've come this far, so don't get code shy now!

"Courageous"

20+ wpm-Congratulations! Okay, the challenge of code is what's gotten you this far, so don't quit now. Go for the Extra class license. We send the code faster than 20 per. It's like wearing lead weights on your feet when you run; you'll wonder why the examiner is sending so slowly!

Classics From 73's Library

- ***The Magic of Ham Radio***, by Jerold Swank W8HXR, begins with a brief history of amateur radio and Jerry's involvement in it. Part 2 details many of ham radio's heroic moments. Hamdon's close ties with the continent of Antarctica are the subject of Part 3. In Part 4 the strange and humorous sides of ham life get their due. And what of the future? Part 5 peers into the crystal ball. Only $4.95.

- ***The Contest Cookbook***, by Bill Zachary N6OP. One of ham radio's winningest contesters lets you in on the tips and techniques of the Big Guns. You'll learn which duping method to use, find out what equipment you'll need, and discover the secret of building a pileup. Includes separate chapters on DX and domestic contests. $5.95 while they last!

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Mail your order to *73* Magazine, WGE Center, Peterborough NH 03458, Attn: Uncle Wayne.

"QSL orders: Allow 4–6 weeks for delivery."

from page 11

send (which, egotistically speaking, I doubt).

For the record, if you ever hear me on the air, I am KE2P/M2. That means I am mobile, very likely in motion (yes, even on CW!), and in the second call district.

Last but not least, I almost worked a guy just last night. I say almost, because after he gave me a 579 report (he was on my receiver), he said he could not copy me. You guessed it: too much QRN. But since he had gotten my call right, KE2/2, imagine my surprise when he asked me to turn my beam toward Florida! Can you imagine a 40 M beam on the back bumper of my little Dodge Omni??!!

Maybe a few guys will have something to think about—at least I got some of it off my chest.

Christopher CJ Johnson KE2P
Fords NJ

STILL A THRILL

I was attracted to ham radio in the 50s because it was a lot of fun, offered a challenge and was a bit more exclusive than bowling. I like sending, receiving, junkboxing, improvising, building, troubleshooting, and making things work.

Being able to copy most anything anyone can send gives me a good feeling. Building a receiver that worked put me on cloud 9 for a long time. My first contact on a homebrew TX will never be forgotten.

I hope the new hams of the 80s can get those same thrills from: 1. Buying 2. Plugging in 3. Talking.

Lee Anderson VE1AYX
Canada

LAW & ORDER

In the July issue you carried a letter from a person who admitted to unlicensed operation on the Amateur Radio frequencies. *73* Magazine has long claimed to be interested in furthering the interest of amateur radio. I am unable to see how unlicensed operation furthers the interest of our hobby.

The problem of unlicensed appliance operators or the amateur radio bands is a problem that we do need to address. We are supposed to be a self-policing fraternity.

Frank Law
Montgomery AL

IT'S A CINCH

I enjoy my subscription to your magazine very much. I like the interesting articles that are intermixed with humor.

I recently acquired my Novice license and can't wait to get on the airwaves. I found both the written and the code test very easy. Here comes the catch. I don't agree with your articles on the no-code license (May '87). There are two reasons for my different point of view:

1) Anyone with true ambition could pass the slow 5 WPM exam, and
2) The prospect of an impossible code discourages those who wish to get a license and can ruin fun for others by resulting in violated laws.

Thank you for considering my opinion on this touchy matter. I would love a reply in any form. Congrats on a great magazine.

Aaron Whitten KB0ANU
Noel MO

CHEERS

I just thought that I would drop you a note telling you how much I enjoy your magazine. I have been relativly inactive in the past 7 or 8 years or so except for some FM usage.

I had recent occasion to read a copy of your magazine and was surprised to see all the things that I was missing including packet.

I also saw that Novices and Techs were allowed to use new portions of our bands. I determined that I should buy a new rig to sharpen my skills on CW in order to upgrade to a higher grade of license. Of course, I read through your magazine to find a good buy. I purchased my new rig from one of your advertisers.The rig is great, and I'm listening to CW every night now. Thank you. I'll spread the word.

George F. Ledoux K1TKJ
Modesto CA

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SATELLITE MOBILE

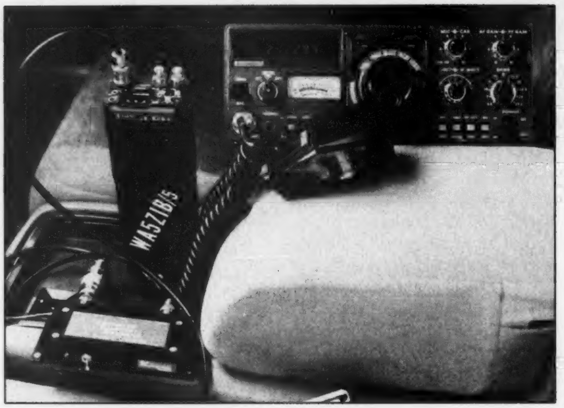
Want to try something a little different? How about mobile satellite work? With RS10/11, it's easier than ever to track satellites from the car. As reported last month, the RS10/11's downlink signals are LOUD and the receivers are quite sensitive. In early July, W2RS worked W1NU via Mode A (two up and 10 down) with only 100 milliwatts from his HT to a rubber-duck antenna. Of course, to get consistent operation, you would want to use a bit more power and antenna. Mobile rigs and antennas do the job nicely.

The new RS satellites have three modes. Modes A and T (15 meters up and two meters down) lend themselves well to mobile operation. Mode K (15 up and 10 down) is possible, but can be very difficult. There are desense problems caused by the 15-meter transmitter's close proximity to the 10-meter receiver and antenna. Since Mode K and Mode T are frequently active at the same time, it's easier to use Mode T and control 15-meter desense by listening on two meters, rather than Mode K's 10-meter downlink. The VHF signals are also less disturbed by atmospheric noise and fading.

Mobile Equipment

Photo A shows my basic Mode T mobile system. The Kenwood TS-130S provides between 50 and 100 Watts output on 15 meters. Since I run about the same power from my home rig to a ground-mounted vertical, the TS-130S looked like a good choice for the car.

For reception, the Santec LS-202A HT does a great job with the Advanced Receiver Research GaAsFET preamp. It took some practice using thumbwheel switches in conjunction with the very small VXO control, but the results were worth it. The several dozen Mode T satellite contacts I've made from my car have allayed any misgivings I may have had about my choice of equipment.



WA5ZIB's Mode-T mobile system. The Kenwood TS-130S provides between 50 and 100 Watts output on 15 meters. For reception, the Santec LS-202A HT is used with the Advanced Receiver Research GaAsFET preamp.

Mobile Antennas

The day after I bought my present car, I drilled holes in it for two-meter and 220-MHz antennas. The two-meter Larsen 5/8-wave whip is fine for satellite work. A nice ball mount in the top of the car's roof would be excellent for a 15-meter antenna, but I opted for something a bit less permanent.

CB mag-mount antennas are relatively inexpensive from discount stores. A sturdy black Sparkomatic antenna with a three-foot whip cost less than $20, and looked like it would come apart for modifications.

Getting into the coil assembly proved to be difficult, but not impossible. It took a vise, a rubber mallet, some light oil, and careful persuasion.

Most CB mag-mounts are similar in wiring if not construction. This one had a 24-turn coil of 16-guage copper wire. One end of the coil connected to the ground side of the RG-58 coax, while the other end went to the fiberglass whip. The coax inner conductor was attached to the coil four turns up from the ground side.

> ***"The new RS satellites have three modes. Modes A and T (15 meters up and two meters down) lend themselves well to mobile operation."***

After a disappointing search through all of my radio manuals and magazines for information on moving 11-meter mag-mount antennas to 15 meters, I made a few calculations and started experimenting. It took several attempts, but the end result worked very well.

On my antenna, the bottom four turns are physically separated from the upper loading coil of 20 turns, so I left the four-turn section alone. It provided impedance-matching and needed no change when moving from 11 to 15 meters.

The upper section of 20 turns required some modification. The 16-guage wire was tightly wound, filling the space provided. I removed it, substituting 26 turns of 24-guage wire. It is not as tightly wound as the previous coil. The turns can be compressed or separated a bit to tune for lowest swr. I made all swr checks with the antenna on the car in the position it would have for later operation. When I got down to 1.2:1 on 21.2 MHz, I taped the upper 26 turns to hold them in place and put everything back together.

In addition to being a great performer for satellite uplinking, this 15-meter mag-mount has also done very well for casual mobile HF operation. The swr is a bit higher around 21.4 Mhz, but the radio still puts out plenty of power for some enjoyable drive-time contacts when the satellites are not in my sky.

I keep another inexpensive mag-mount in the trunk for Mode-A downlink operation. It is also an ex-CB antenna, which I have tuned for 10 meters.

This is very easy to do. Instead of adding turns, simply remove one or two off the top end. Then, start checking the swr for resonance in your favorite part of 10 meters. I had considered setting mine for resonance around 29.4 MHz, but opted instead for 28.4 MHz to have good transmitter operation in the most active part of the band. Satellite receive sensitivity was not impaired at 29.4 MHz, and the HF activity has been a lot of fun in the middle of the new Novice phone band.

Pitfalls

If mobile satellite activity is so easy, why doesn't everyone do it? Because, while dealing with receiver desense, ignition noise, power-line noise and signal fading, you are supposed to be driving without running into anyone!

These problems, with the exception of receiver desense, are minimized by stationary mobile operation. Ignition noise can come from your vehicle, but it is surprising how much comes from other cars, trucks and, especially, motorcycles. A radio with a good noise blanker really helps.

Most of my "mobile" contacts occur when I am parked. I use roadside rest stops while on long trips, or parking lots and friends' driveways while in town. For those few mobile-in-motion QSOs, I have been the passenger or have had a good co-pilot to watch Doppler shift, the logbook, and the traffic.

Power-line noise is something with which all mobile enthusiasts have to deal. If you are looking for a place to catch a satellite pass, search for a quiet spot. It is embarrassing to be in the middle of a good contact just to have it overwhelmed by high tension lines or a bad pole transformer. With HF mobile, a few minutes to get by the noisy area is no problem. With satellite mobile work, a few minutes could represent a large part of the whole pass. Even a good noise blanker may not help.

Simple vertical antennas can have problems with signal fading on both uplink and downlink signals. Other antenna designs could help on two-meters. Turnstiles and horizontal halos are two examples. Fortunately, the signals from RS-10/11 are so good, that the fading problems won't keep you off the air. Don't expect dramatic results on extremely low horizon passes, but also don't be surprised if you can hear Mode T downlink signals well over S9 on a 20-degree pass.

Mobile-to-Mobile

Eventually it had to happen. While catching a quick RS-11 pass out in the office parking lot one day, I tuned across N6DGK doing the same thing. I don't know how many mobile-to-mobile contacts have occurred via hamsats, but they are certainly not common.

Tom N6DGK runs whip antennas on ball mounts. A Yaesu FT-77 and a Kenwood TR-9000 keep him on the air for Modes A and T. You may also run into Tom on Fuji-OSCAR-12. When F-O-12 is in Mode JA, the analog mode, it, too, can provide quality contacts from simple mobile or portable earth stations.

Many hams have found that high uplink power levels and GaAsFET preamps for downlink reception are not necessary for RS-10/11 operation. Obviously, high-gain antenna arrays aren't required, either.

Even if you don't go for satellite mobile work, at least get some two-meter and HF gear together at the house and join the new RS crowd. Many previously unheard calls have shown up, and I have had the pleasure of providing first-ever satellite contacts to several pioneering enthusiasts.

AMSAT Annual Meeting

The 1987 AMSAT General Meeting and Fifth Annual Space Symposium is almost upon us. The AMSAT gatherings used to take place only in the Washington, DC area, but have since occurred in Los Angeles, Vail, and the Dallas-Fort Worth area.

Why not make plans to attend this year? The site will be the Southfield Hilton, just north of Detroit MI, Saturday November 7th. This location is within a one-day drive of a very large percentage of U. S. amateur radio operators and space enthusiasts.

The Space Symposium is composed of many fine forums. They are usually scheduled sequentially. This year there are so many talks set up for Saturday, there will be two occurring simultaneously throughout the day. Because of this conflict, an effort has been made to keep the technical hamsat talks opposite more generalized space topics. This will allow those interested in science and spaceflight to fill the day with pertinent material, while the dedicated hamsat chaser can sit in on technical nuts-and-bolts discussions. A copy of the proceedings (the technical papers) will be available to fill in the gaps during those times when you can't be in two places at once.

Last year's AMSAT Conference in North Texas was one of the best ever. The AMSAT area coordinators in Ohio, Indiana and Michigan have been working hard to make this year's event another success. With live demonstrations, displays, and exhibits, and a grand selection of banquet prizes, no one should be disappointed.

If you are an AMSAT member, you will be receiving the conference registration materials. If not, then call AMSAT today at (301) 589-6062 for the appropriate forms. By attending, you will find out how best to use our present hamsat resources and are guaranteed a glimpse into the future of amateur satellite projects from now till the year 2000.

Satellite Updates

The new RS10/11 combo continues to be a major news topic. This newest satellite pair has provided us with a functional communications medium for the beginning satellite chaser. They've also provided new challenges to long-time hamsat users who prefer low-earth-orbit satellites. No schedule of operation has been reported, but from all indications, Modes K and T on either RS-10 or RS-11 will likely be dominant.

Fuji-OSCAR-12 devotees have been rewarded with some short-term scheduling. Typically we have seen a day of recharge for every day of operation. The operating days have been split almost evenly between Modes JA and JD, analog and digital modes respectively. To keep up with changes on F-O-12, monitor the AMSAT nets.

AMSAT-OSCAR-10 is scheduled to emerge from hibernation in early November, when sun angles will allow guarded transponder operation. In mid-December, solar panel illumination will be close to 100 percent. The last fully illuminated period, which was around Field Day, provided excellent signal levels and DX contacts. Operator restraint, with careful attention to scheduling information, is the only way to prolong the life of this veteran satellite.■

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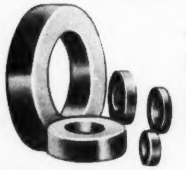

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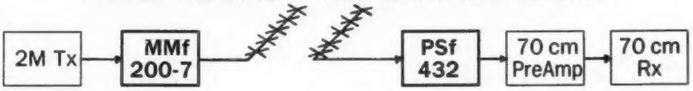

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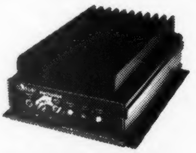

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GETTING ON THE AIR IN PIECES

I've had many love/hate relationships in my life. Perhaps the most intense of these affairs have been my encounters with various electronics kits.

Ah! Ameco, Knight Kit, Heathkit®, Eico! Just the mention of those immortal names brings the bittersweet smell of burning solder to my nostrils and makes my fingers yearn to bend a resistor lead or two.

I was bitten by the kit bug early in my ham career, before I got my first ticket. My initial project was an Ameco AC-II, a 40-meter transmitter that allegedly generated about 20 Watts of undiluted rf energy. I think the ad copywriter was under the influence of hyperbole. Still, to a 13-year-old, it had the same kind of allure as a Collins rig.

As with all kits, the easiest part of this project was buying the AC-II and bringing it home. In splendorous innocence, I opened the box, tipped it upside-down and spilled all of the components out on the kitchen table. Fortunately, the AC-II was a relatively simple kit, so it didn't take me long to re-sort those parts and rectify my error.

The next several nights were spent in a glorious haze of frenzied activity. You know, I've often wondered if burning solder has some sort of narcotic effect. I don't know what medical science has to say on the subject, but I do remember being kind of high during that time. Perhaps it was the sheer exhilaration of becoming a "real ham."

A REAL HAM! Just as primitive tribes take male adolescents into the field to be ritually tattooed or scarred, I received my mark of manhood that night. I still proudly carry my fraternal solder-burn scar on my left forearm. I wouldn't part with it for all the laser surgery in the world.

Three days later, I completed my project. That evening, my Elmer came over to judge my work. He laughed. I think it had something to do with the resistors that swayed gently on three-inch-long leads or the crooked sockets that made the tubes stand as true as windswept trees. Then again, perhaps it was the fact that so many of the components protruded from the chassis' bottom panel that it was all but impossible to place the unit on a conventional tabletop. I told my Elmer I planned to operate the transmitter sideways. He laughed again and promised to make "a few changes." Three days later, the AC-II was back in my hands, looking considerably more polished. You could now place it on a table, for instance.

My next project, about two years later, was a Heathkit Sixer—the famous Benton Harbor Lunchbox. I had my Tech ticket by then, and was very anxious to get on six meters despite the current sunspots minimum and the fact that channel 2 was the local CBS affiliate.

By this time, I had learned the lesson of keeping leads short. What I neglected to remember was that power circuits can pack a mighty wallop even several minutes after power has been shut off. The smell of burning flesh killed my interest in the Sixer and I gave it to a friend.

Over the intervening years, I guess I've built at least a dozen kits, including a 2-meter repeater, an oscilloscope, a low-band receiver, a VTVM, and a QRP transceiver. All of these projects were completed with various degrees of success. But my most recent project, tackled after a seven-year layoff, was an exercise in future shock—a packet radio terminal node controller. There must be something in common between an Ameco AC-II and a terminal node controller kit, but I'll be damned if I can tell you what it is. Upon opening the kit's box, I felt like a blacksmith magically transported into the 21st century. I knew I was in serious trouble when I couldn't even identify more than 50 percent of the parts. I started calling components "that black round thing" and "the blue-red bubble whatever."

At first, the kit and I got along splendidly. I spent three evenings soldering components to a printed circuit board, an action not as soul-satisfying as point-to-point wiring but infinitely easier.

Night four was my Armageddon; the Gotterdammerung of my kit-building career. That was the night the chips had to be plugged into their sockets.

Friends, let me tell you, God as my witness, I didn't know you couldn't comb your mustache with the legs of a CMOS chip. In fact, as I later discovered, you can't even safely wiggle your ears within 20 yards of one. Tubes were, and still are, indestructible. Chips are, well... *very* destructible.

So, in perfect hindsight, I now realize that I caused at least $200 in damage to my kit before I even plugged the damn chips into the circuit. As it turned out, I should have given up while I was playfully stacking the chips on my kitty cat's back. I didn't. I proceeded—innocently and blindly. And I encountered an additional, more obvious, problem.

Fellow radio amateurs, fifty-pin dual-inline chip packages were not meant to be inserted into sockets by hand, manufacturer's claims to the contrary. It just doesn't work. Human hands cannot make them fit. These chips were designed to be inserted by machine and with machines they should stay.

One by one, almost systematically, I single-handedly destroyed 15 chips that evening. Before the night was over, pins were bent, pins were twisted and pins were broken. Likewise, my kit-building spirit was bent, twisted, and broken. That evening, I did something unprecedented in 20 years of assembling electronics kits, with all its frustrating times and happy times: I cried.

In a flash, I realized my kit construction days were behind me. Technology, flying as fast as a bullet in the night, had passed me by. Feeling like a worker whose job has been made superfluous by progress—like a lamplighter, telegrapher, or milkman—I reluctantly put down my soldering iron.

Sometimes, on cold winter evenings, I still think of my old Ameco AC-II, with its mercury-vapor tube casting a hazy blue glow across the decades. The thought makes me nostalgic, but I know I'll never build another kit. ■

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The unit is extremely well engineered and rugged and delivers a good account of itself in chart service. It is competitive, price-wise, with systems using a dot matrix printer (hardware plus printer) and will deliver superior results with no compromise and essentially no noise! If you want to copy HF weather charts, the Alden *Weatherchart* recorder is certainly a system you should look at. Based on the cost of paper (in lots of 6 cassettes), your per-chart cost will run about $.22—you will want to be selective in your choice of charts from the daily schedule once the novelty has worn off. A digital timer to turn the unit on and off at selected times of the day would do the job nicely.

Satellites

As it stands, the Alden recorder is *not* suited for weather satellite use. At the very least, to provide 120 LPM printout of TIROS/NOAA and METEOR imagery, it would require an external AM video and printing circuit in order to demodulate the satellite signal and get a good grayscale. Even if you made those modifications, you would not be able to copy GOES or METEOSAT WEFax pictures since the line rate and IOC are off (you would need 240 LPM and an IOC of 288). But that gets us to the reason why I was interested in looking at the Alden despite my fixation on satellite pictures. Keep an eye on the WEATHERSAT column and I will show you how the Alden or *any* Fax machine can be used to copy excellent pictures from *any* weather satellite, regardless of any incompatibilities in format! The Alden is a rugged, reliable package offering you satellite possibilities.■

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*Touch-Tone is trademark of AT&T

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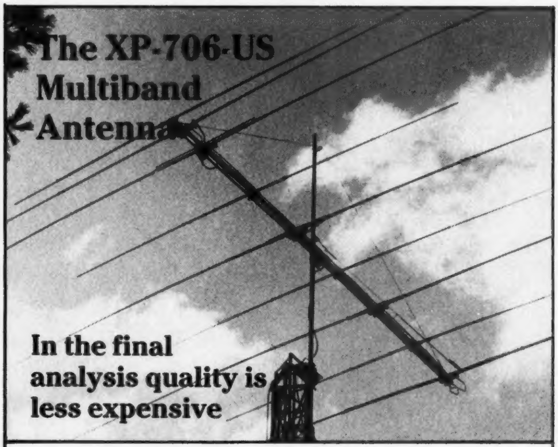
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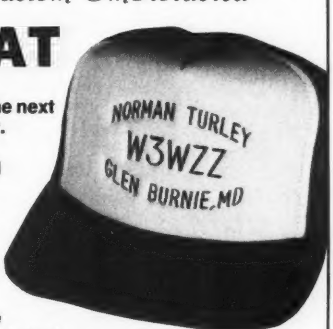

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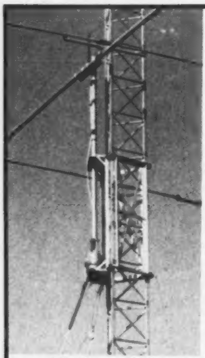

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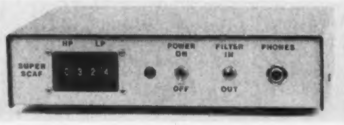

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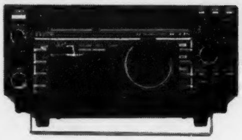
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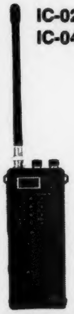
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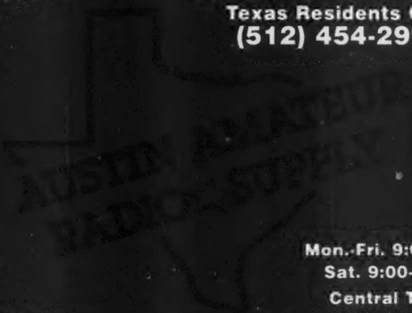

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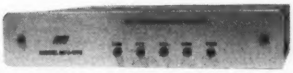

SPECIAL EVENTS

MARFA CHAMBER OF COMMERCE
OCT 2–4

The Big Bend ARC will operate K5FD on Oct. 2-4, from the Marfa Lights Festival from 1500Z - 0000Z on suggested frequencies: Phone—3.920, 7.250, 14.250, 21.400, 28.400. For certificate, send QSL and SASE to Stewart Billingsley N5HXZ, PO Box 1458, Marfa TX 79843.

T.A.R.A. HAMFEST
OCT 3

The TRI-STATE AMATEUR RADIO ASSOCIATION will hold their Annual Hamfest at the Huntington Civic Center, Huntington, WV Saturday Oct. 3, from 9 a.m. to 4 p.m. Admission is $4 and flea market tables are $4. All activities are inside. Talk-in 146, 16/76. For more information contact Paul Patton NT8M, PO Box 652, Huntington WV 25711.

CARA SWAPMEET
OCT 3

The annual swapmeet of the Cochise Amateur Radio Association will be held at the club's Training Facility on Moson Road, Sierra Vista AZ. Talk-in on 146.16/.76. No charge for tailgaters. Refreshments available. Contact Jacquie Kelly KD7DZ,(602)-458-4107 or write CARA, PO Box 1855, Sierra Vista AZ 85636.

CLOVIS CA
OCT 3–4

The Diamond Jubilee Special Event Station. The Fresno Amateur Radio Club emergency communications van will operate W6TO in the City of Clovis for their Octoberfest-Crafts Faire-Pioneers' Day, on the site of their newly remodeled downtown. For a handsome certificate, QSl 8½x11 SASE to W6TO F.A.R.C., PO Box 783, Fresno CA 93712-0783. Operating time is 1500Z Oct. 3 to 0100Z Oct. 4, 1987. Suggested frequencies: lower portions of General 80/40/20/15M bands, Novice phone 28.450, CW 7.130 and 2 meter rpt. 146.82/22 or 146.94/34.

MODEL T COMMEMORATAION
OCT 3–4

The Ford Amateur Radio League, the Tin Lizzie Club, will operate K8UTT and member stations Oct. 3 and 4, 1200Z to 2200Z, to commerorate the first Model T Ford built Oct. 1, 1908. Operations in the General portions of the 80-40-20 meter bands. For 8½ x 11 certificate, send SASE and QSL to member station or to K8UTT, Ford Amateur Radio League, Box 2112, Deerborn MI 48123-2112.

TOPEKA KS
OCT 3–4

The Kaw Valley Amateur Radio Club will operate W0CET, its Memorial Call Sign Station Oct. 3 and 4 as a special event station in celebration of John Amis' call sign 9CET. Suggested frequencies: 10 m, ±28.400; 20m, ±14.275; 40m, ±7.275. Time will be 1500Z–2300Z for both days. For a certificate, send a SASE to Terry Hoss KA0BHO, 2931 Tutbury Tn. Rd., Topeka KS 66614.

12TH ANNUAL HAMFEST
OCT 3–4

The ARRL Virginia State Convention and 12th Annual Hamfest/Computer Fair will be at Virginia Beach Virginia Pavilion on Saturday and Sunday, Oct. 3 and 4. Don't miss seeing all the latest equipment that will be presented by ALINCO, ICOM, KENWOOD AND YAESU. ARRL VEC license upgrade exams will be given Sunday at 9 a.m. For more information and tickets, call or write Manny Steiner K4DOR, 3512 Olympia Lane, Virginia Beach VA 23452; (804)-340-6105.

ALEXANDRIA VA
OCT 3–4

The Mount Vernon Amateur Radio Club will operate K4US from Gunston Hall Virginia on Oct. 3 and 4, starting at 1500Z each day to commemorate the Constitution of the U.S. This is in coordination with the Bicentenial Commision of the U.S. Frequencies will be 25 kHz up from the bottom of the General portion of 80 SSB, 40 CW, 20 SSB, and 10 m Novice SSB. HF -Packet station will also be operating. Send QSL and SASE to Steve Schneider WB4EEA, 8602 Cushman Pl., Alexandria VA 22308.

FULLERTON CA
OCT 4

The Rehab Radio program at St. Jude Hospital in Fullerton, California will mark its tenth anniversary on the air with a special event operation. The operation will be chiefly on 10 meters (28.3 to 28.6 MHz) and 15 meters (21.3 to 21.4 MHz). In case of poor band conditions on 10 and 15, there may be operation on 20 meters (14.2 to 14.3 MHz). Sometime will also be devoted to two meter FM operation on local repeaters. WD6BPT special event station operation will commence Sunday, October 4 from 2000Z to 2400Z, with an open house at the station from 2100Z to 2400Z. Send QSLs to WD6BPT, St. Jude Hospital, PO Box 4138, Fullerton CA 92635.

SALT PLAINS LAKE OK
OCT 4

Salt Plains Amateur Radio Club Eye Ball QSO Party at the South Side of Salt Plains Lake, North Central Oklahoma on October 4 on talk-in 147.30/90 or call Gary Gerber KB0HH (316)-842-5079.

WEST LIBERTY IA
OCT 4

The South East Iowa Hamfest sponsored jointly by the Muscatine and Iowa City Radio Clubs will be held at the West Liberty, Iowa Fairgrounds. ARRL/VEC Exams start at 10 a.m. with walkins accepted. A Saturday Night Campers Special weiner roast with all you can eat, hay-rack rides, flea market under the stars, and a fox hunt. Gate opens at 7 a.m. Oct. 4. Talk in will be held on 146.31/.91, 146.25/.85 and 146.52. For information contact Ken KA0Y at (319)-648-5037 or Tom KE0Y at (319)-264-3259; or write Muscatine Iowa City Amateur Radio Club, PO Box 5466, Coralville IA 52241.

SPRINGFIELD OH
OCT 4

The Independent Radio Association will be holding the Fifth Annual Springfield Ohio Hamfest and Computer Expo on Sunday, Oct. 4, from 8 a.m. to 4 p.m., at the Clark County Fairgrounds. Talk-in on 145.45 or 224.26 MHz. For advanced reservations write the Independent Radio Association, PO Box 523, Springfield OH 45501 (SASE), or call Steve KA8QCS, at (513)-882-6521.

YONKERS NY
OCT 4

The Yonkers Electronics Fair and Giant Flea Market will be held at the Yonkers Municipal Parking Garage, Yonkers NY. The event will be sponsored by the Yonkers Amateur Radio Club on Oct. 4 at 9 a.m. to 4 p.m. Talk-in on 146.865/R, 440.150/R or 146.52. For more information write YARC, 53 Hayward St., Yonkers NY 10704; (914)-969-1053.

ROME GA HAMFEST
OCT 4

The Rome Georgia Hamfest sponsored byt the Coosa Valley Amateur Radio Club will be held on Sunday, Oct. 4, at the Rome Civic Center. Amateur Exams by Central Alabama VEC begin at 8 a.m. sharp. Reservations requested but walk-ins will be accepted. For more information contact Bobbie Carol Waller KA4DXU, 24 Wellington Way, SE Rome GA 30161; (404)-235-5417.

WARRINGTON PA
OCT 10

The Pack Rats (Mt. Airy VHF ARC) cordially invites all amateurs and their friends to the 11th Annual Mid-Atlantic VHF Conference on Saturday, Oct. 10 at the Warrington Motor Lodge, Warrington PA. For advance registration write to, Hamarama '87, PO Box 311, Southampton PA 18966; or call Pat Cawthorne WB3DNI, at (215)-672-5289 for more information.

DEERFIELD NH
OCT 10

The Hosstraders will hold their fall Tailgate Swapfest on Saturday Oct. 10 at the Deerfield NH Fairgrounds. Friday night camping at nominal fee, but aboslutely no admission before 4 p.m. Friday. Profits benefit Shriners' Hospitals. For a map send a SASE to Norm Blake WA1IVB, RFD Box 57, West Baldwin ME 04091.

DALTON GA
OCT 10–11

The Dalton Amateur Radio Club will operate special events station KI4IG on Oct. 10 and 11, from 1400Z to 2000Z at the Prater's Mill County Fair activities. Suggested frequencies (all ±): 7.250, 14.250 and for Novice 28.400 MHz. For special QSL card, send your QSL and SASE c/o Dalton ARC, PO Box 143, Dalton GA 30722-0143.

HARLINGEN TX
OCT 10–11

The South Texas Amateur Repeater Society (STARS) announces the operation of N5CAF October 10–11 at 1400Z to 2300Z to commemorate the annual confederate Air Force Airshow held in Harlingen Texas. Suggested frequencies: 7250 kHz, 21325 kHz and 28400 kHz. A special commemorative QSL will be available to all stations worked. Send QSL and SASE to Dr. David Woolweaver K5RAV, 2210 S. 77 Sunshine Strip, Harlingen TX 78550.

WICHITA KS
OCT 10–11

The Wichita A.R.C. will host the 1987 Kansas State ARRL Convention and Ham Fest at the Broadview Ramada Hotel in downtown Wichita, Kansas. Doors will open at 9 a.m. both days. Indoor Flea Market, Saturday night banquet and Sunday morning breakfast. Talk-in on 146.82-600. Preregistration and dealer information contact: Vern Heinsohn WA0ZWW, %Wichita Amateur Radio Club, 707 N. Main, Wichita KS 67203; (316)-264-2796.

LANSING CIVIC CENTER
OCT 11

Ham Fair '87 will be held in a new location this year, at the Lansing Civic Center in Lansing MI on Oct. 11. It is the Central Michigan's Largest Amateur Radio Event. The talk-in frequencies: 145.39 and 146.94. For more information and reservations contact Rowena Elrod KA8OBS, 11 Lancelot Place, Lansing MI 48906; (517)-482-9650.

TRI-CITIES HAMFEST TN
OCT 17

The Seventh Annual Tri-Cities Hamfest will be held Saturday, Oct. 17 at the Appalachian Fairgrounds, Gray TN. Talk-in on 146.37/97 and 146.01/61. For further information write: Tri-Cities Hamfest, PO Box 3682 CRS, Johnson City TN 37602.

SYRACUSE NY
OCT 17

The Radio Amateurs of Greater Syracuse will be holding their 32nd hamfest in the Arts and Home Center at the New York State Fairgrounds on

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30TH SCOUT JAMBOREE ON THE AIR
OCT 17-18

Jamboree On The Air, or JOTA, is an annual Scouting/Amateur Radio event sponsored by the World Bureau of the World Organization of the Scout Movement. Calling Frequencies are: CW-3,590; 7,030; 14,070; 21,140; 28,190. Voice-3,940; 7,290; 14,290; 21,360; 28,990. Please move off these frequencies to avoid QRM. and PACKET, RTTY, SSTV, ATV on usual frequencies.

EDMOND
OCT 17-18

The Edmond Amateur Radio Society, a special service Club, will operate W5ERY from 1700Z October 17 to 1700Z October 18. This in celebration of Edmond Amateur Radio Society 30th Anniversary as an Amateur Radio Club. The Special Event Station will be operated on the shores of beautiful Lake Aracdia. Suggested frequencies include: 3.870, 7.270, 14,100 (CW), 14,270 and 147.135 +. For more information, contact Edith Vaughn KA5YPX, 1020 Juno Circle, Edmond OK 73034.

MARSHALL MO
OCT 17-18

The Indian Foothills ARC will operate WB0WMM from the National Cornhusking Championships on October 17 and 18, 1400Z to 1900Z each day. Suggested frequencies: CW-7.11 and 21.11, phone- 7.235 and 14.235. For certificate send a large SASE and QSI to WB0WMM (callbook address) or 125 Lakeview, Marshall MO 65340.

POTEAU OK
OCT 17-18

The Fort Smith AR Area ARC will operate special event station W5ANR in conjunction with the 1st Annaul Green Country Sorghum Festival to be held in Poteau OK. Operation will be from 1500 to 0300Z Oct. 17 and 1500 to 2300Z Oct. 18 in the lower 30 kHz of the general phone bands, 28.435 in novice phone and 145.01 on packet. For certificate, send QSL and SASE to FSAARC W5ANR, Box 32, Fort Smith AR 72902-0032.

CARLISLE PA
OCT 18

On October 18 the C-CARS will sponsor the 4th Annual Cumberland County Hamfest at the Carlisle Fairgrounds 7 a.m. to 3 p.m. C-CARS is the Third Call Area QSL Bureau and you may put envelops on file. Talk-in on 145.52 and 433.3. For additional information send a SASE to C-CARS, PO Box 448, New Kingston PA 17072.

QUEENS NY
OCT 18

The Hall of Science ARC Hamfest will be held at the New York Hall of Science parking lot on October 18. (The raindate will be October 25). It starts at 9 a.m. to 3 p.m. on Flushing Meadow Park, 47-01-111 Street, Queens New York. Amateur Radio exhibit station, tune up clinic, films. Talk-in 144.300 simplex link 233.600 repeat and 445.225 repeat. For further information call at night Steve Greenbaum WB2KDG at (718)-898-5599, or Arnie Schiffman WB2YXB (718)-343-0172.

LAKE TEXOMA LODGE OK
OCT 24-25

"NASA and Amateur Radio - Past, Present and Future," featuring Lou McFadin W5DID, NASA's SAREX Project Manager, will headline the programs at TEXOMA HAMARAMA '87, scheduled for Lake Texoma Lodge, over looking beautiful Catfish Bay. Also on the progam of this ARRL sanctioned hamfest will be the ARRL Forum with West Gulf Director Jim Haynie, and Vice Director Tom Comstock; and technical programs presented by ARRL Technical Advisor Al Markwardt, and others. A full line of Ladies' programs, amateur exams, indoor and out door fleamarkets, dealers and QCWA activities are also on tap. For additional information contact: Texoma Hamarama Association, PO Box 610892, DFW Airport TX 75261.

HEART OF OHIO HAM FIESTA
OCT 25

The Marion Amateur Radio Club will hold its 13th Annaul Heart of Ohio Ham Fiesta on Sunday, Oct. 25, from 0800 to 1600 hours at the Marion County Fairgrounds Coliseum. Talk-in on 146.52 or 147.90/.30. For information, tickets, or tables contact Ed Margraff KD8OC, 1989 Weiss Ave., Marion OH 43302; (614)-382-2608.

KALAMAZOO MI
OCT 25

The Southwest Michigan Amateur Radio Team and the Kalamazoo ARC are Sponsoring the 5th Annual Kalamazoo Hamfest. New larger location at the Kalamazoo Central High School on Oct. 25 at 8 a.m. to 4 p.m. Talk-in on 147.64/.04 and 146.52. Walkin VE testing. For more information send SASE before Sept. 28th to Jim Hastings/Kalamazoo Hamfest 1813 Greenbiar Dr., Kalamazoo MI 49008.

WAUKESHA WI
OCT 25

The Kettle Moraine Radio Amateur Club Inc. will hold its annual Ham Computer, Video Fest at the Waukesha County Exposition Center on Sunday Oct. 25 at 8 a.m. Please contact KMRA Club, 313 Hillview Circle, Waukesha WI 53188 for more information.

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All models include preamp	
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Shure 444D	54.95
Ameco PT-3	Soon
New Tokyo HC 200A	115.00
Astatic MC321 Cartridge D104	12.00
Ten-Tec Mobile Switch 3001	17.00

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Isopole 440 MHz	59.95
Cushcraft 124-WB (146 MHz)	33.00
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HF2V. 80 & 40 vertical	119.00
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Hustler G7-144	119.95
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CINCH 12 pin conn fitz (Drake etc.) female	3.00
Aerovox 1000 pf/500 V feedthrough caps	1.95
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31-216 UG201 A/U N Male-BNC Female	2.00
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34025 N Male. RG58	3.00
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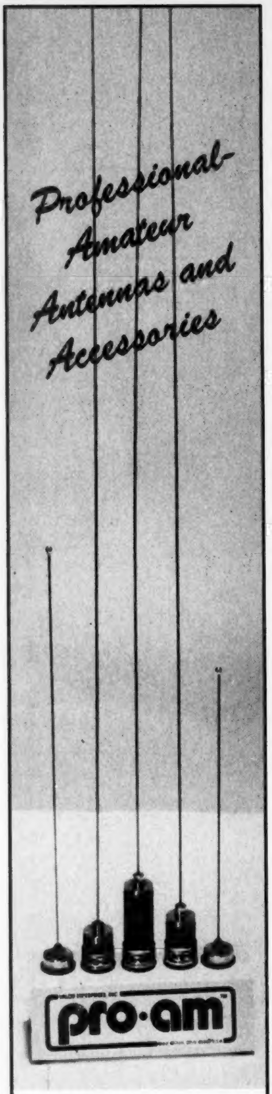

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Model	MHz	Input	Output	NF-dB	Gain-dB	+Vdc	A	Conn.
0508G	50-54	1	170	.6	15	13.6	28	UHF
0510G	50-54	10	170	6	15	13.6	25	UHF
NEW! 1409G	144-148	2	160	.6	15	13.6	25	UHF
1410G	144-148	10	160	6	15	13.6	25	UHF
1412G	144-148	30	160	6	15	13.6	20	UHF
2210G	220-225	10	130	.7	12	13.6	21	UHF
2212G	220-225	30	130	7	12	13.6	16	UHF
4410G	420-450	10	100	1.1	12	13.6	19	N
4412G	420-450	30	100	1.1	12	13.6	19	N

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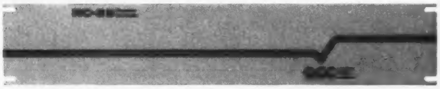

The RC-85 controller offers the high tech basics of repeater control, plus! Of course, much of what we consider to be the "basics" aren't found *anywhere else, at any price.*

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AM TRANSMITTER WANTED: 500w up, plate modulated. Bob Mattson KC2LK, 10 Janewood, Highland, NY 12528 (914) 691-5247. BNB611

MARCO: Medical Amateur Radio Coucil, operates daily and Sunday nets. Medically oriented amateurs (physicians, dentists, veterinarians, nurses, therapists, etc.) invited to join. For information, write: MARCO, Box 73's, Acme, PA 15610. BNB612

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KENWOOD 430S owners only! Stop Scan automatically resumes the scan AFTER the transmission finishes! SASE for free brochure. Kit $19.95. Assembled $29.95. JABCO ELECTRONICS, R1, Box 386, Alexandria, IN 46001. BNB614.

WANTED. DRAKE R7A, MS7. All letters answered. Tony Ficarra, 144 Gladstone Avenue, Wollongong. NSW. Australia 2500. Phone (042) 292573. BNB615

Gonset Commander Transmitter and Super 6 Receiver; both work; very good condition; $75.00 OBO. (417) 781-5243, Jon Danford, 2115 Joplin Ave., Joplin MO 64801. BNB616

DX Adventure on Montserrat only $300/week. Details: Chod Harris

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ICOM u2AT OWNERS—Full transceive mod. Send your rig & check for $25.00. 24 hr turn around. Add $10.00 for Fed-X shipping. Jim Hong KA8ZGP, 3404 Pine Ridge Drive, Jackson, MI 49201. BNB619

SCARA INDOOR HAM RADIO AND COMPUTER FLEA MARKET. Sundya, November 15, l987 at the North Haven Park and REcreation Center, 7 Linsley Street, North Haven, CT. Sellers admitted at 7 a.m., Buyers from 9 a.m. to 3 p.m. Tables are $10.00 in advance, $15.00 at the door. General admission $2.00 per person. Talk-in on 146.01/.61. Reservations for tables must be received with check by Nov. 4, l987, and NO reservations by phone. For information or reservations, S.A.S.E. to: SCARA Fleamarket, P.O. Box 81, North Haven, CT 06473 or call between 7 p.m. and 10 p.m. Brad at (203) 265-6478. BNB620

WANTED: EQUIPMENT AND RELATED ITEMS. The Radio Club of Junion High School, 22 NYC, Inc. is a non-profit organization, granted 501 (c) (3) status by the IRS, incorporated under the laws of the State of New York with the goal of using the theme of Ham Radio to further and enhance the education of young people. Your property donation would be greatly appreciated and acknowledged with a receipt for your tax deductible donation. Please contact WB2JKJ using the callbook or telephone (516) 674-4072, 24 hours, seven days a week. Thank you. BNB621

WANTED: Opertional A.C. Power Supply for GONSET G-76 Transceiver, K8HVG, 3520 Campbell, Dearborn, MI 48124. BNB622

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Homebrew projects lists. SASE WB2EUF, Box 708, East, Hampton, NY 11937. BNB626.

"QSLs & RUBBER STAMPS—TOP QUALITY! States, World Maps, USA, Key, Shuttle, Globe QSLs. Report Form Rubber Stamps. More! Sample Pack—50 cents—Ebbert Graphics D-7, Box 70, Westerville, OH 43081" BNB627

DEAD BATTERY PACK??? Ni-Cad cells / inserts / rebuilding. AA 500mah $1.50, (W/Tabs $1.65) 2/3aa 270MAH $1.85, 2/3af 450MAH $2.40, iCOM bp3 270MAH iNSERT $14.95, KW/TR 2400 Insert (minus plus) $18.95. OR: Mail your pack to us for a Rebuild-Quote. If you don't accept, we return, NO CHARGE! In PA add 6% Add $2.00 S&H/order. CUNARD ASSOCIATES R.D. 6, Box 104, Bedford, PA 15522. BNB628

WANTED: Cop Victern one program tape. For vicmodem phone. For Vic-20 computer. Larry Bailey, 303 Lansing Ave, Louisville, KY 40214. BNB629

CODE PROGRAMS. Apple/C-64 37 Modes, Graphics, Lessons, Wrdprcsr, etc. LARESCO, POB 2018, 1200 Ring Road, Calument City, IL 60409 (312)891-3279. BNB507

COMMODORE CHIPS. Authorized Distributor, Factory Fresh. #6526/6510-$9.95, #6581-$12.85, #6567-$14.75, #8701-$7.25, PLA/82S100-$12.50, 901225/226/227/229-$10.95 and many others....Heavy Duty Power Supply for C64-$27.95...Call Toll Free 800-248-2983 (outside NY or 914-356-3131. Kasara Microsystems, Inc. 33 Murray Hill Drive, Spring Valley, NY l0977. BNB529

COMMODORE REPAIRS. We are the largest Authorized Service Center in the country and we repair your Commodore computer within 3 to 4 days. (Our prices are low; eg. C64-$39.95). New ROMS just received for updating C-128/1571, A MUST. C64 Power Supply $27.95. Call Toll Free 800-642-7634 (outside NY) or 914-356-3131. Kasara Microsystems, Inc., 33 Murray Hill Drive, Spring Valley, NY l0977. BNB587

Never Say Die

from page 63

for $80. Blank video tapes were about $50 each.

They do a pretty good job of keeping all this quiet. Other than a communist newspaper from New York, I saw no American papers or magazines—even for sale to tourists. I checked the short wave bands frequently with my Sony and never heard a single Voice of America station able to get through the Russian jammers. I've heard that the thousands of jamming stations are run mostly by Russian hams. Makes sense.

I didn't see any American TV programs. Heck, they don't have many radio or TV stations. I tuned the broadcast band and heard a couple weak stations in Moscow and two strong ones in Leningrad. FM? One station part time. No wonder they read a lot of books. Without much radio, TV and movies, what else? Lines, I guess.

Though I'm glad I went, Im not anxious to go back. Oh, if I could visit some of the other Soviet republics I might do it—mostly to get my country-visited count up and partly to see if things are as drab and dreary all over the USSR.

I shopped hard in their tourist stores, looking for something to bring back. The only thing which came close was a toy Russian car which I almost bought just to show how poor the quality of the Russian cars is. The toys all had crooked and bent doors—very realistic—even worse fitting than American cars!

If Russia ever lets its people know what a difference there is between their life style and that of America, Europe and a growing bunch of Asian countries, I'll bet the students would start a new revolution. That might keep the government too busy to continue their mischief in Nicaragua, Cuba, Angola, Mozambique, Burma, Syria, Iraq, Afghanistan, and so on.

No, I don't think Fritos are a measure of the success of a country, but where you have one example after another of what free enterprise can accomplish in building a country rapidly and providing its people with a quality of life in food, education, entertainment and happiness, I can't give the Russian system much credit.

Funny thing—most of the daily tours showed us churches—almost all taken over by the government and either closed or used as museums. In Suzdal there were 36 churches, with only one permitted to still be used. Yet, they have little else to show. Even after 70 years of communism there's not much to show.

Their schools still depend mostly on rote learning to pass exams—and unless they pass difficult exams they aren't permitted to advance in their "education" and they're be stuck in a low-paying job. Since memorization has been proven to be one of the least efficient ways to educate people, they've got a terrible problem. But let's not let them know about it since one of the last things we need is a more progressive and efficient Soviet Union stiring up trouble to destabilize the world.

If I do decide to try another trip to Russia, I'll try to start two years ahead and work my way through their bureaucracy so I can visit a ham club. I'll also know to bring along Kleenex, soap, toilet paper, plenty of medical supplies and lots of gum to give the kids.

Their view is that our having twenty kinds of soap in our supermarkets is a waste—who needs more than one? How can we explain that it's the twenty brands of soap being available which pays for our television entertainment—for our magazines, radio. It's the competition which keeps prices low and quality high. Our system works very well—their's doesn't.

Yes, there are some private enterprises in the USSR, but they are only family or group enterprises, since no one is permitted to hire anyone for a salary. This puts a lid on the size of businesses, keeping them entirely mom and pop.

If you're able to actually talk with any of the Soviet hams please let me know.■

73 INTERNATIONAL

NOTES FROM FN42

THE October day to celebrate is Saturday the 24th—United Nations Day. The various October days celebrated by nations around the world will be listed here as usual, so hams can say Happy (whatever) as appropriate, but on the 24th all hams everywhere can say with special emphasis, Hello Brother! (Frere, Bruder, Hermano, Brat... and for the word in Chinese, the sixth official United Nations language, we'll have to ask our correspondent, Chang Han Dong.) You are on your own with any of the other nearly 200 languages of the world (spoken by a million or more; there are countless spoken by smaller populations.)

National Day: 1—China, Cyrus, Nigeria; 12—Spain (Dia de la Raza); 26—Austria. National Foundation Day, 3—S. Korea; 7—E. Germany. National Holiday, 28—Greece. Three Independence Days: 4—Lesotho; 12—Equatorial Guinea; 28—Czechoslovakia.

Republic Days: 5—Portugal; 9—Kmer Republic, Cambodia; 27—"3Zs" Day, when Zaire became the Republic of Zaire; 29—Turkey. The 8th is Constitution Day in the USSR, the 20th is Guatemala's Anniversary of the 1944 Revolution, and the 21st is Revolution Day in Somalia.

The 2nd is Erntedankfest in Germany, and Canada's Thanksgiving Day is on the 12th. Latin America and the US can be thankful on Columbus Day, also on the 12th. Mothers get thanked in Malawi the 17th, King Chulalongkronis on his Day in Thailand on the 23rd.

The 10th—Health-Sports Day, Japan; 14th—Young Peoples Day, Zaire; 22nd—Labor Day, New Zealand; 31st—Hallowe'en in the U.S.

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AUSTRALIA

Jim Joyce VK3YJ
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Victoria
Australia

NOVICES ON TWO METERS

Australia is now also going through the dilemma of—will we? or won't we?—have Novice operators on two meters. We have, of course, the usual on-air comments both for and against, with a poll being conducted by the WIA magazine, submissions to the Department of Communications, and so on. Below is a proposal by Jim Linton VK3PC and Rodger Harrison VK2ZTB that looks at the problem and offers a viable alternative to the head-in-the-sand destructive criticism so common today within the amateur radio fraternity.

It is with the authors' and WIA's permission that I reprint this, as it does in part go along a route similar to the USA Novice amateur license.

License Restructure Proposal

The need for restructure of Australia's license system has been ignored by the 1987 WIA Federal Convention proposal to give Novices the entire two-meter (144–148 MHz) band.

That proposal, generated at the Convention, and supported by Federal Councillors from all Divisions except VK1, arose out of two considerations.

The first was the desirable "common band" for all grades of license. The second, which was the major factor in intense lobbying at the Convention, was the impact of the JA/VK reciprocal licensing agreement.

That agreement, effective from February, has consequences for the Novice license and Australia's license restructure generally.

Japan has a long-established telephony license, with an exam of a lower level than the Australian Novice and no telegraphy exam. The JA Telephony licensees operate on low power on HF bands other than 10 and 14 MHz.

Under the JA/VK reciprocal agreement, such JA licensees visiting Australia have been given permission to use FM (10 W) on all bands 50 MHz and above.

How the agreement was reached, the WIA's involvement, and the full story about that exercise is unclear. But what is plain is that the agreement now has a direct influence on the license structure in Australia.

The fact is that should an Australian Novice licensee take the Department of Communications to the Administrative Appeals Tribunal on equal opportunity grounds, DOC could not defend the denial of Australian Novice's telephony privileges on all bands 50 MHz and above. It has brought about a *de facto* Telephony license in Australia.

In hindsight, a two-year tenure should have been placed on the JA Telephony licensees operating in Australia under the reciprocal agreement. It is essential that the agreement be re-negotiated to include a tenure.

To attract the bottom-rung beginner in radio and to expose them to the broad scope of the hobby of amateur radio, a Telephony license should be introduced in Australia.

The theory syllabus for this license could include the necessary elements of basic electricity, magnetism, radio frequency generation, modulation, propagation and interference.

This grade of license could have FM telephony privileges on 52.500–54.000 MHz and a segment on 70cm, at a maximum power of 10 W.

The Australian Telephony license must have a limited tenure of two years.

An integral part of restructuring the license system is restoration of the Novice license syllabus and question bank pool. It has become clear that the Novice license with its recently revised syllabus no longer adheres to its original intention or definition.

The Novice license should be given additional privileges identical to the Telephony license on six meters and 70 centimeters, but with a maximum power output of 30 Watts—plus SSB on the segment 52.030–52.200 MHz.

The enhancements for the Novice proposed above are designed to be greater than those given to JA licensees under the reciprocal agreement, meet the common-band requirement, yet are not a disincentive to upgrade by giving Novices the entire two-meter band.

A further aspect of license restructure should be the introduction of an intermediate license, to serve two purposes.

Firstly, to bridge the gap between the Novice and AOCP/ Limited licenses, and secondly, to attract those people who increasingly these days gain an interest in electronics through computers and computing. It is an essential step if the Amateur Radio Service is to survive by being more attractive to people of all ages.

The intermediate license would require a candidate to have passed the Novice theory, plus a supplementary exam on elementary digital subjects and FM. It would have the six-meter privileges afforded to the Novice license, plus 70cm segments on 433–435 and 438–440 MHz covering FM simplex FM repeaters and digital modes, but all selected to avoid the satellite band.

A candidate who passed the intermediate theory exam/s and the Novice telegraphy exams would have the Novice HF privileges plus permission to use RTTY, AMTOR, ASCII, FAX, SSTV and Packet on the segment 28.200–28.300 MHz.

The data mode privileges would enable Australian intermediate licensees to communicate with USA Novices who have those privileges on that band segment.

Being examined on FM, the Intermediate licensees should either be permitted into the FM international segment 29.000–29.700 MHz and/or FM repeaters be allowed in Australia within the current Novice band.

Intermediate licensees should have access to the 1.2 GHz band in the future.

Holders of the combined Novice/Limited (K-call) license would automatically be given the digital and other HF privileges of the Intermediate license.

The above restructure of Australia's license system would make the hobby appropriate to today's technology and improve its attractiveness to potential radio amateurs. It sets out new entry points into the hobby, and a logical upgrading path leading to increased numbers of licensees with AOCP and Limited license qualifications.

The particular privileges proposed in this document represent a balance between a number of conflicting considerations including the consequences of the JA/VK reciprocal agreement. These privileges are intended to encourage upgrading by those who have the motive to attain the skills.

The aim is to give newcomers an attainable entry into the hobby. Later, the intermediate license gives a taste of digital modes, encouraging further upgrading.

Linton-Harrison License Restructure Chart

Unrestricted (AOCP)	All bands and modes. Full power.
Combined (K-call)	Limited privileges plus Intermediate HF privileges
Limited	All bands 50 MHz and above. No mode restrictions. Full power.
Intermediate (Without CW)	Novice six and 70cm plus FM and digital.
Intermediate (With CW)	As above plus Novice HF bands, 10-meter digital and FM.
Novice	HF 80,15,10; 6-meter SSB and FM, 70cm FM. VHF/ UHF power 30 W.
Telephony (2-yr. tenure)	Six meter, 70cm, 10 Watts FM

The document follows on from the discussion paper: "Amateur Radio—Future Direction," co-authored by VK3PC and VK2ZTB in December of 1985. Like that document, its purpose is to promote discussion. It does not necessarily reflect the official viewpoint of the WIA or any division of the WIA.

BRAZIL

Carlos Vianna Carneiro PY1CC
Afonso Pena, 49/701
20270 Rio de Janeiro
Brazil

SIX NEW AWARDS

Being part of a Brazilian CW group like the Carioca Woodpeckers, PPC, means keeping a permanent watch about all CW practice around the world. To develop the use of normal bands, to bring friends to the amusement of multibands, the Brazilian PPC has just launched six new awards, greeting not just Brazil but friends on all continents.

Our 5BPPC Award required working five different Brazilian prefixes on each band: 10-15-20-40 and 80 or 160 meters, "AND one PPC member per band, no matter which band for PPC members' QSL."

Now the following join PPC's more than 20 funny awards: All for contacts valid from January 1, 1985; GCR list, no QSLs for any of the awards; 5 IRCs fee for each: 5BABR (5 bands Brazil), 5BAEU (Europe), 5BAAS (Asia), 5BAAF (Africa), 5BAAM (Americas), and 5BAOC (Oceanie).

5BABR. Work three Brazilian QSOs (at least two different states) per band (same bands plus 80 or 160) for 15 QSLs total, two of which must be PPC members.

For each of the other 5 awards: Work three QSOs per band (same five bands) with at least two different countries of the specific continent on each band, plus one QSL with a PPC member, for 16 QSLs.

Request awards from: PPC Awards Manager, PO Box 18003 Rio, Rio de Janeiro 20720 Brazil.

Locator System Awards

The PPC group is also working on the IARU World Locator system, and has two new awards, the PYLOC and the PPPY1.

PYLOC. Work Brazilian amateur stations employing the IARU locator system, six-digit locator on site shown as prime QTH on their licenses. (Temporary allowance is made for use of geographical coordinates until locator system is completed.) A station may operate from a site other than its prime QTH; portables must clearly show LOC corresponding to site.

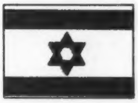
QSL valid from January 1, 1986. Initial series of 100 LOC (subsquares spread over at least five Fields; followed by four series of 25 LOC each and one additional Field each, minimum. GCR, no QSLs, 5 IRCs to PPC Certificate Manager at the same address as the Awards Manager, a few lines above.

PPPY1. Like PYLOC but QSLs from operators within the states of Espirito Santo (PP1) and Rio de Janeiro (PY1). Initial series of 50 LOC spread in at least two squares, followed by four series of 15 subsquares each, and one additional square each, minimum. GCR, no QSLs, 5 IRCs to Certificate Manager.

The Carioca Woodpeckers Group is preparing QTH Locators for all its members, and computer programs are doing a fine job although accurate coordinates are not easy to find for some members living far from main centers.

If you are interested in knowing all of the 28 PPC awards, send an SASE and one IRC to the address of the Certificate Manager.

And, by the way, this year's WWSA CW Test was very, very good. We are planning plenty of first class modifications so friends will find still better conditions to face 1988's World Wide South America CW Contest!



ISRAEL

Ron Gang 4Z4MK
Kibbutz Urim
Negev M.P.O. 85530
Israel

POSTAGE STAMP HONORS AMATEUR RADIO

On June 14, the Israel Post Office issued a stamp valued at 2.50 Shekels [*US $1.55 on 7/28 - Ed.*] honoring radio amateurs. Along with the stamp and first-day covers bearing the insignia of the Israel Amateur Radio Club, was distributed a pamphlet out lining the history of amateur radio in the country, its significance in communications emergencies, and as a technically enriching activity.

Behind the scenes, Mark Stern 4Z4KX, IARC Awards Manager and collector of amateur radio postage stamps, had been lobbying the Post Office Philatelic Service for years to issue a ham radio stamp. Mark's persistence at last bore fruit and with excitement he announced to us that in time for the IARC's 40th birthday the postal authorities would put out the stamp.

In a special ceremony on the first day of issue, in which Mark, representatives of the IARC, and the Ministry of Communications took part, the stamp and first-day cover were presented along with many speeches praising the public service record of the amateur radio community in Israel. Officials from the Ministry said that they would work to preserve the interests of the amateurs in international conferences. Thus, the worldwide family of hams can count on one more country to cast its vote in favor of preserving the ham bands.

The IARC has purchased a quantity of first-day covers of the stamp, and these will be available on a first-come, first-serve basis. Those interested should send a check—which will cover all costs—for US $5.00, payable to the Israel Amateur Radio Club for each first-day cover desired. Mail to IARC Stamp, POB 4099, 61040 Tel-Aviv, Israel.

IARC ANNUAL ASSEMBLY

The end of June saw the membership of the IARC convene in Tel-Aviv to elect new officers for the coming year, discuss Club policy, issue awards of merit, and get together for an opportunity for eyeball QSOs.

Speaking for the Ministry of Communications, Mr. Alon Bar-Sela 4X1AB announced that Sweden, Australia, and Paraguay have signed reciprocal licensing agreements with Israel and negotiations are going on with two other countries. He also said that the Israeli representatives to the upcoming international conference on the mobile radio service had been instructed to vote in the interests of the amateur radio service.

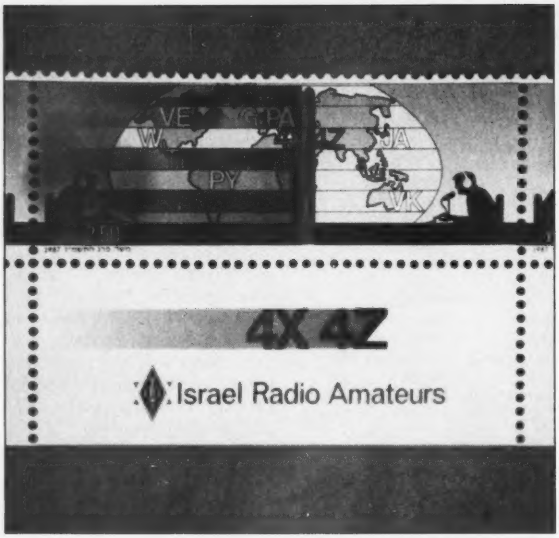
Amongst the recipients of certificates of special merit, Shimon Kushnir XE1GGU is of special note to our readers. During the Mexican earthquake disaster, Shimon single-handedly formed the Mexican end of a round-the-clock link that originated thousands of health and welfare messages to relatives and concerned parties in Israel.

INFORMATION NEEDED

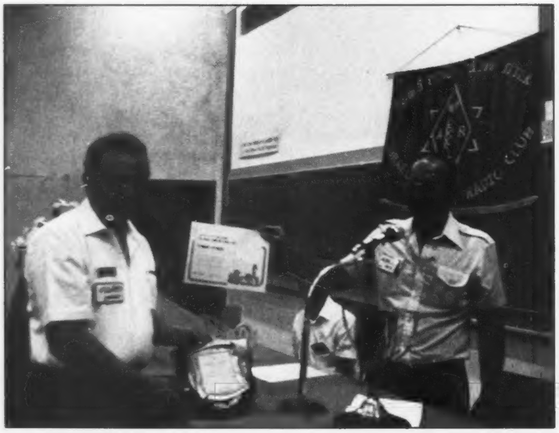
Many hams in Israel and all over the world received certificates from the Amateur Radio Association of Mexico in recognition of their work during the Mexico calamity. Shimon is compiling a book on the traffic-handling activity between Israel and Mexico during that period and will be greatly appreciative of any information you may have on the matter, personal stories, newspaper clippings, etc. Please address to Shimon Kushnir XE1GGU, Monte Chimborazo 580–402, Mexico City 10 D.F., Mexico.

HAMS GIVE EXAMS

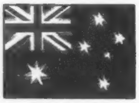
For the first time, the Ministry of Communications' amateur radio examinations for all three classes of licenses were administered by volunteers of the IARC, under Ministry supervision. The Club is working on a bank of multiple-choice questions that will speed up marking; and exams are being held four times a year now instead of twice because of the added volunteer manpower. More and more youngsters are being heard on the air—an encouraging sign when in many countries hams are bewailing the lack of new blood.



The 2.50 Shekel stamp honoring amateur radio. This is from the bottom strip of a page of stamps. "Israel Radio Amateurs" appears on the stamp in Hebrew. The first-day cover has the words in both English and Hebrew, and the special cancellation includes the IARC logo.



XE1GGU (left) receives a plaque and certificate from Rami Shlain 4Z4LX for his Mexico disaster emergency work.



NORFOLK ISLAND

Kirsti Jenkins-Smith VK9NL
PO Box 90
Norfolk Island 2899
Australia

ISLAND INVADED

Modern times continue to catch up with us here. One year ago it was decided that we should not have TV on the Island due to the high cost involved. But recently, out of the blue, a gentleman came along who set about to show us what we were missing. He conducted TV tests for one week by picking up the AUSSAT satellite TV channel with a dish antenna on the Island's 900-foot-high Mt. Pitt and retransmitting the signal for all and sundry to receive in their living rooms.

Needless to say, this exercise whet the appetite. A petition was signed by enough people to put pressure on the local government, and, *hey, presto!* From August 1987, the radio amateurs on Norfolk Island had to start reading up on TVI!

In a way it is the end of an era. Until now we have been able to skip whole chapters of radio handbooks and lengthy articles in many publications. But now our unconcerned freedom from TVI has ended. Of course, there has been the odd claim of VCR interference. VCR has been around for years and some of the hire tapes are badly copied, with squiggles and lines. It became popular a few years ago to blame the poor quality on amateur radio. There was even dire talk of having amateur radio banned as "a public nuisance," but this was never put to the test. During a period of low activity, ham-radio-wise, while Jim and I were both off the Island, the squiggles and lines remained, and perhaps the penny dropped. In any case, people began to understand that copies of tapes which have been viewed so many times that they have become just about transparent do not make for crystal-clear VCR performance.

TVI Teapot Tempest

Norfolk Island comes under Australian laws regarding communications and related matters. In recent times, the Government introduced a new law governing standards of electronic equipment. In theory, it is an offense to sell, buy, or own a substandard piece of equipment which does not satisfactorily reject rf. It is doubtful that this law was made for the benefit of amateur radio. It was more likely a means to combat people picking up signals from other and more sensitive transmissions on their toasters, electronic organs, VCR, etc. However, it is to be hoped that in the long run the law will also benefit amateur radio, so that when the neighbour who owns a little radio built into a teapot or ashtray complains of interference, the average amateur will have a leg to stand on, and won't have to transform a two-bob radio into a legally acceptable receiver just to keep the peace.

The potential TVI problem is something else. In the normal manner of resident operators, houses on the Island have enough distance between them for this not to be an unbeatable obstacle. But visiting hams who want to operate from their hotel rooms may meet some objections. Hotels and holiday apartments will have television sets installed in all rooms.

TVI will raise its ugly head the way it does in cities of apartment blocks. Unless, of course, the average tourist continues to appreciate the freedom from TV, the getting-away-from-it-all, which up to now has been one of the slogans used for attracting visitors to the Island, may have to be reconsidered. Time will show.

HAM POPULATION UP 14%!

Meanwhile, the resident amateur radio population has increased. Phil VK9NP is active on all bands including 160. He operates SSB, RTTY, and some CW. QSL Phil direct to PO Box 39, Norfolk Island 2889, Australia. Being employed on the Island, Phil should be with us for some time to come. By joining us, he has swelled the number of licensed amateurs on Norfolk Island to eight.

PHILIPPINES

Leo M. Almazan WA6LOS/DU2
10098 Knight Drive
San Diego CA 92126

Hello, again, everyone. It's been a year since I wrote last for the International Column. I am now working at the Naval Ocean Systems Center here in San Diego in one of the premier R&D labs of the Department of the Navy. My projects, however, will provide me an opportunity to travel to both Clark Air Force Base and Subic Naval Base, in DU-land, at least twice a year, so I still will continue to provide interesting write-ups on amateur radio activities there with the help of a lot of my DU and portable DU friends.

CHANGES

A lot has happened in the Philippines since my last article last year. Of course, everyone by now has heard of the "peaceful" revolution that occurred February, last year. With the demise of the Marcos regime also came sweeping changes in the whole administrative structure of the government.

The National Telecommunications Commission has a new commissioner. Commissioner Sy has replaced Brigadier General (Ret.) Carreon. Rumor has it that the redistricting of amateur call prefixes will be in parallel with the current political districts.

DU1 will stay as is, but DU2 to DU9 will change: DU2 (and /DU2, Clark AFB and Subic NB) will be DU3s, which was the Mountain Province district. Most of the grumbling probably will come from DU6 to DU9, where the ham population is next only to DU1 in terms of numbers.

REVOLUTION

The February Revolution of 86 will always be remembered in the history of amateur radio in the Philippines. Hams all over the country provided almost all the primary and secondary communications during the revolution. When the revolutionary radio station, Radio Veritas, was bombed by the Marcos loyalist force, an Army major from the revolutionary force called Joe Mari Gonzales DU1JMG for help, knowing that Joe had a powerful set-up at his home QTH. Joe, always the consummate ham, accepted the request knowing full well the consequences of the action he was about to undertake.

DU1JMG, using his station on 40 meters, received news and information via landline or from two-meter stations in the revolutionary camps, and broadcast this information on 7.045 MHz. A secret standard broadcast station in Metro Manila, using a phony callsign, and many other commercial stations in Visayas and Mindanao picked up the broadcast and rebroadcast it from their stations to everyone's delight and the Marcos' chagrin.

This was important because of the news blackout during the first two days of the revolution. And from all indications, DU1JMG's broadcast was heard all over Asia, the Pacific, and on the west coast of the United States!

A threatening call from one of the Marcos's generals to DU1JMG made the whole thing verrrrry interesting indeed! (DU1JMG, for your information, is alive and well . . .)

Well, this is it for now. By the way, I am writing—or should I say, typing—this article on a lap-top computer by Data General, somewhere in the North Pacific Ocean, aboard a Navy cruiser. Nothing else to do aboard a ship if you are a civilian. I really admire these sailors who have to stay aboard this tin can for six months. Me, I'm out of here in two days.

Good DX, and 73.■

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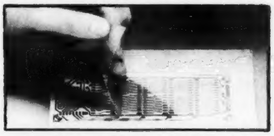

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Jim Gray W1XU

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ALASKA	14	14	7A	7	7	7	7	7A	14	14	14	14
ARGENTINA	21	14	14	7A	7	7	7A	14	14A	21A	21A	21
AUSTRALIA	21	14	7A	7B	7B	7B	7	7	7	7B	14	14A
CANAL ZONE	14	14	7A	7	7	7	7A	14	14	14	21	21
ENGLAND	14	7A	7	7	7	7A	14	14	14	14A	14A	14A
HAWAII	21	14	14A	7	7	7	7	7	14	14	14	21
INDIA	14	14	7B	7B	7B	7B	7A	14	14	14	14	14
JAPAN	14	14	14B	7B	7B	7B	7B	7B	14B	14	14	14
MEXICO	14	14	7A	7	7	7	7	14	14	14	14A	14
PHILIPPINES	14	14	14B	7B	7B	7B	7B	14B	14	14	14	14
PUERTO RICO	14	14	7A	7	7	7	14	14	14	14	14A	14A
SOUTH AFRICA	7	7	7	7	7B	14	14	14	14A	14A	14	14
U. S. S. R.	7A	7	7	7	7	7B	14	14	14A	14A	14	14
WEST COAST	14A	14A	14	7	7	7	7	14	14	14	14A	14A

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	14	7	7	7	7	7	7A	14	14	14
ARGENTINA	21	14A	14	7A	7	7	7A	14	14A	21A	21A	21
AUSTRALIA	21	14	7A	7B	7B	7B	7	7	7	7B	14	14A
CANAL ZONE	21	14	7A	7	7	7	7A	14	14	14A	21A	21
ENGLAND	14	7A	7	7	7	7	7A	14	14	14	14A	14
HAWAII	21	14	14A	7	7	7	7	7	14	14	14	21
INDIA	14	14	7A	7B	7B	7B	7B	7A	14	14	14	14
JAPAN	14	14	14	7B	7B	7B	7B	7B	14B	14	14	14
MEXICO	14	14	7	7	7	7	7	7	14	14	14	14
PHILIPPINES	14	14	14	7B	7B	7B	7B	14B	14	14	14	14
PUERTO RICO	14	14	14	7	7	7	14	14	14	14	14A	14A
SOUTH AFRICA	7	7	7	7	7B	7B	14	14	14	14A	14	14
U. S. S. R.	7A	7	7	7	7	7B	14B	14	14A	14	14	14

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	7A	7	7	7	7	7	14	14	14	14
ARGENTINA	21	14A	14	14	7	7	7	14	21	21A	21A	21
AUSTRALIA	21A	14A	14	14	7A	7A	7	7	7	7B	14	21
CANAL ZONE	21	14	7A	7	7	7	7A	14	14	14	21A	21
ENGLAND	14	7A	7	7	7	7	7B	7A	14	14	14	14
HAWAII	21A	14A	14	14	7A	7	7	7	14	14	21	21
INDIA	14	14	14	7A	7B	7B	7B	7A	14	14	14	14
JAPAN	14A	14A	14	14	14B	7B	7B	7B	14B	14	14	14
MEXICO	14	14	7A	7	7	7	7	14	14	14	14A	14A
PHILIPPINES	14A	14	14	14	14B	7B	7B	14B	14	14	14	14
PUERTO RICO	14A	14	7A	7	7	7	7	14	14	14	14A	14A
SOUTH AFRICA	7	7	7	7	7B	7B	7B	14	14	14A	14	14
U. S. S. R.	7B	7B	7	7	7	7	7B	14B	14	14	14	14
EAST COAST	14A	14A	14	7	7	7	7	14	14	14	14A	14A

A = Next higher frequency may also be useful.
B = Difficult circuit this period.

First letter = night waves. Second = day waves.
G = Good, F = Fair, P = Poor. * = Chance of solar flares.
# = Chance of aurora.

NOTE THAT NIGHT WAVE LETTER NOW COMES FIRST.

October is the fall contest month and will provide good DX conditions on more than half of the days. However, it looks as if the weekends may not be as uniformly good as hoped for. The first, second and third weekends of the month look to be sub-standard on the HF bands, while the last two weekends appear to be about normal for this time of year. Daylight hours are getting shorter and the HF bands are expected to close even earlier in the evening than last month. Propagation on 40 and 75/80 meters will continually improve. For those of you who operate 30 meters, Europe will be coming through in the late afternoon and early evening. Keep looking for good grey-line DX conditions in the mornings around sunrise when VK-ZL and other Pacific stations ought to be heard clearly.

OCTOBER

SUN	MON	TUE	WED	THU	FRI	SAT
				1 G	2 G–F	3 P
4 F–G	5 G	6 G–F	7 F–P	8 P	9 P	10 P–F
11 F	12 G	13 G	14 G	15 G–F	16 F–P	17 P
18 P	19 P	20 P	21 P	22 P–F	23 F	24 G
25 G	26 G	27 G	28 G	29 G	30 G	31 G

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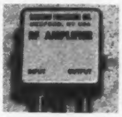

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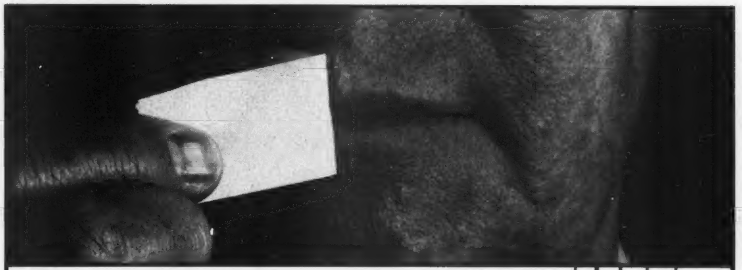

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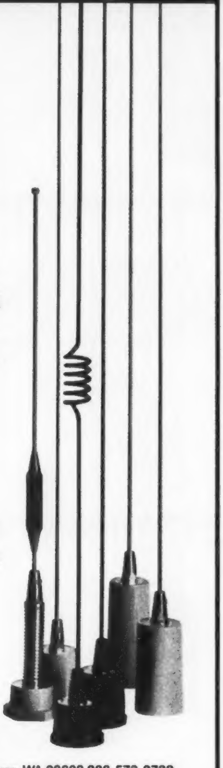

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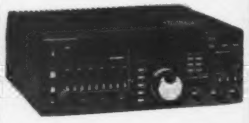

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- Coverage 150-174 MHz 450-474 MHz
- Call For Low, Low Prices

FT-290R

- 2M, All Mode Portable Transceiver
- Use Either 12V Battery (25W Output) or C-cell Battery Pack (2.5W Output)
- SSB, CW, FM
- Ten Memories, Dual VFO's
- FT-690R for 6M Operation

FT-109RH

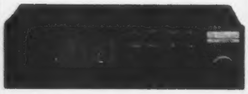
- 220 MHz Handheld
- 5W Output
- Ten Memories
- Battery Saver
- Memory And Priority Scanning
- FT-209RH - 2m
- FT-709RH - 440 MHz

FT23/73R

- Super "Mini" HT's
- Zinc-Aluminum Alloy Case
- 10 Memories
- 140-164 MHz, 440-450 MHz
- 2W Battery Pack or Optional 5W Pack

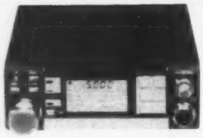
FT-727R

- Two Affordable Radios in One
- 2m/440 MHz Handheld
- 5W On Both Bands
- Ten Memories
- Multi-Scan Systems
- Battery Saver



FT-211RH

- 2m, FM, Mobile
- 45W Output
- LCD Readout
- Ten Memories
- Also, FT-711RH For 440 MHz



FT-2700RH

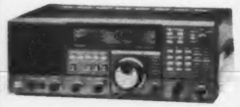
- Dual Band Mobile FM Transceiver
- 2m/70cm
- 25W Output
- True Full Duplex Operation

FL-7000

- Solid-State Amp For 160-15M
- Built-In Power Supply
- Automatic Tuner
- 1200W PEP Input

YAESU ACCESSORIES

- Antenna Tuner
- Battery Packs
- Charging Units
- Power Supplies
- Microphones
- DC Car Adapter
- SWR/Power Meters
- And Lots More



FRG-8800

- General Coverage Receiver
- 150 kHz to 29.999 MHz
- All Mode Reception
- Multi-Scanning Feature
- Two Built-in 24 Hour Clocks

FRG-9600

- All Mode Receiver
- Covers 60 MHz - 905 MHz
- 100 Memory Channels
- Multiple Scanning Systems
- YAESU CAT System

FT-726R

- All-Mode Tribander
- 10w on 2 meters
- Choose from 10m, 6m, 430-440 MHz, 440-450 MHz
- 11 Memories

[illegible]

Yaesu's FT-736R.
Because you never know who's listening.

Why just dream of talking beyond earth?

With Yaesu's new FT-736R VHF/UHF base station, you can discover some of the best DX happening in ham radio. Via moonbounce. Tropo. Aurora. Meteor scatter. Or satellites.

You see, the FT-736R is the most complete, feature-packed rig ever designed for the serious VHF/UHF operator. But you'd expect this of the successor to our legendary FT-726R.

For starters, the FT-736R comes factory-equipped for SSB, CW and FM operation on 2 meters and 70 cm (430-450 MHz!), with two additional slots for optional 50-MHz, 220-MHz, or 1.2-GHz modules.

Crossband full duplex capability is built into every FT-736R for satellite work. And the satellite tracking function (normal *and* reverse modes) keeps you on target through a transponder.

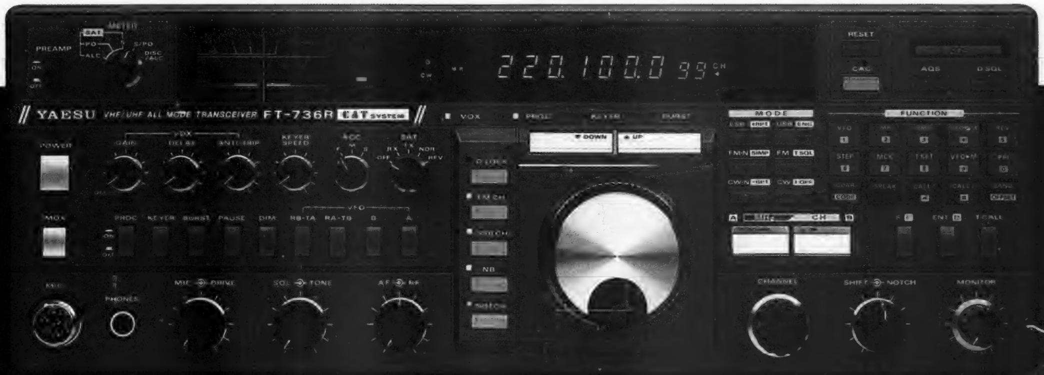
The FT-736R delivers 25 watts RF output on 2 meters, 220 MHz, and 70 cm. And 10 watts on 6 meters and 1.2 GHz. Store frequency, mode, PL frequency, and repeater shift in each of the 100 memories.

For serious VHF/UHF work, use the RF speech processor. IF shift. IF notch filter. CW and FM wide/narrow IF filters. VOX. Noise blanker. Three-position AGC selection. Preamp switch for activating your tower-mount preamplifier. Even an offset display for measuring observed Doppler shift on DX links.

And to custom design your FT-736R station, choose from these popular optional accessories: Iambic keyer module. FTS-8 CTCSS encode/decode unit. FVS-1 voice synthesizer. FMP-1 AQS digital message display unit. 1.2-GHz ATV module. MD-1B8 desk microphone. E-736 DC cable. And CAT (Computer Aided Transceiver) system software.

Discover the FT-736R at your Yaesu dealer today. But first make plenty of room for exotic QSL cards. Because you *never* know who's listening.

YAESU



Yaesu USA 17210 Edwards Road, Cerritos, CA 90701 (213) 404-2700. **Repair Service:** (213) 404-4884. **Parts:** (213) 404-4847
Yaesu Cincinnati Service Center 9070 Gold Park Drive, Hamilton, OH 45011 (513) 874-3100.

Prices and specifications subject to change without notice. PL is a registered trademark of Motorola, Inc. FT-736R shown with 220-MHz option installed.

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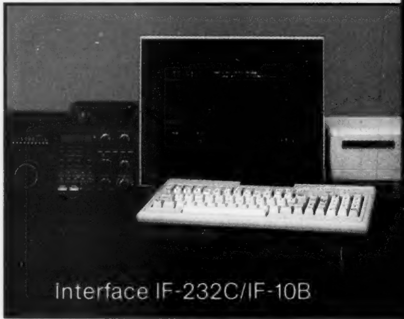
#1 Rated HF

"DX-cellence!"

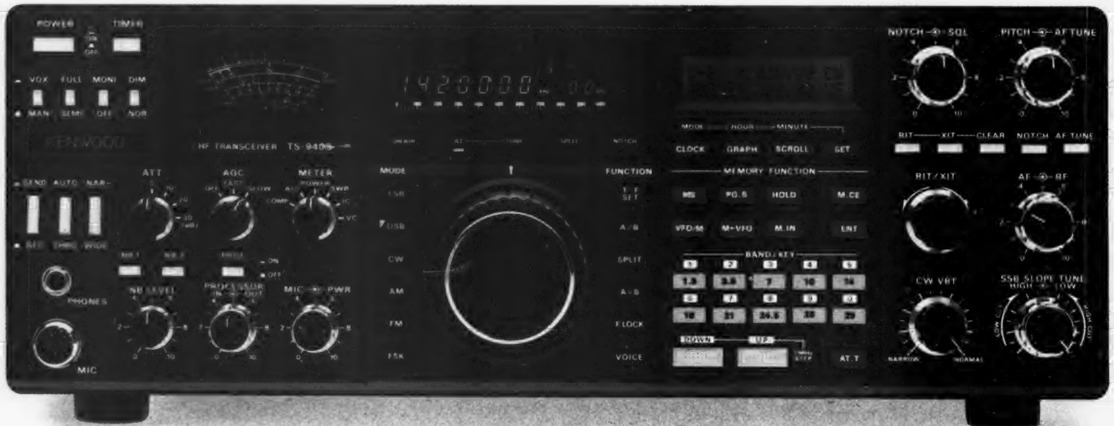
TS-940S

The new TS-940S is a serious radio for the serious operator. Superb interference reduction circuits and high dynamic range receiver combine with superior transmitter design to give you no-nonsense, no compromise performance that gets your signals through! The exclusive multi-function LCD sub display graphically illustrates VBT, SSB slope, and other features.

- **100% duty cycle transmitter.** Super efficient cooling system using special air ducting works with the internal heavy-duty power supply to allow continuous transmission at full power output for periods exceeding one hour.
- **High stability, dual digital VFOs.** An optical encoder and the flywheel VFO knob give the TS-940S a positive tuning "feel."
- **Graphic display of operating features.** Exclusive multi-function LCD sub-display panel shows CW VBT, SSB slope tuning, as well as frequency, time, and AT- 940 antenna tuner status.
- **Low distortion transmitter.** Kenwood's unique transmitter design delivers top "quality Kenwood" sound.
- **Keyboard entry frequency selection.** Operating frequencies may be directly entered into the TS-940S without using the VFO knob.
- **QRM-fighting features.** Remove "rotten QRM" with the SSB slope tuning, CW VBT, notch filter, AF tune, and CW pitch controls.
- **Built-in FM, plus SSB, CW, AM, FSK.**
- **Semi or full break-in (QSK) CW.**
- **40 memory channels.** Mode and frequency may be stored in 4 groups of 10 channels each.
- **Programmable scanning.**
- **General coverage receiver.** Tunes from 150 kHz to 30 MHz.
- **1 yr. limited warranty.** Another Kenwood First!


Interface IF-232C/IF-10B

Optional accessories:
• AT-940 full range (160-10m) automatic antenna tuner • SP-940 external speaker with audio filtering • YG-455C-1 (500 Hz), YG-455CN-1 (250 Hz), YK-88C-1 (500 Hz) CW filters; YK-88A-1 (6 kHz) AM filter • VS-1 voice synthesizer • SO-1 temperature compensated crystal oscillator • MC-43S UP/DOWN hand mic. • MC-60A, MC-80, MC-85 deluxe base station mics. • PC-1A phone patch • TL- 922A linear amplifier • SM-220 station monitor • BS-8 pan display • SW-200A and SW-2000 SWR and power meters.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USB
CW
AM
FM
FSK
FUNCTION
A/B
SPLIT
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SCROLL
SET
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M.IN
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UP
AT.T
NOTCH SQL
PITCH AF TUNE
RIT
XIT
CLEAR
NOTCH
AF TUNE
RIT/XIT
AF RF
CW VBT
SSB SLOPE TUNE
HIGH LOW
NARROW
NORMAL

Complete service manuals are available for all Kenwood transceivers and most accessories.
Specifications and prices are subject to change without notice or obligation.

More TS-940S information is available from authorized Kenwood dealers.

KENWOOD

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P.O. Box 22745, Long Beach, CA 90801-5745